Design Engineering

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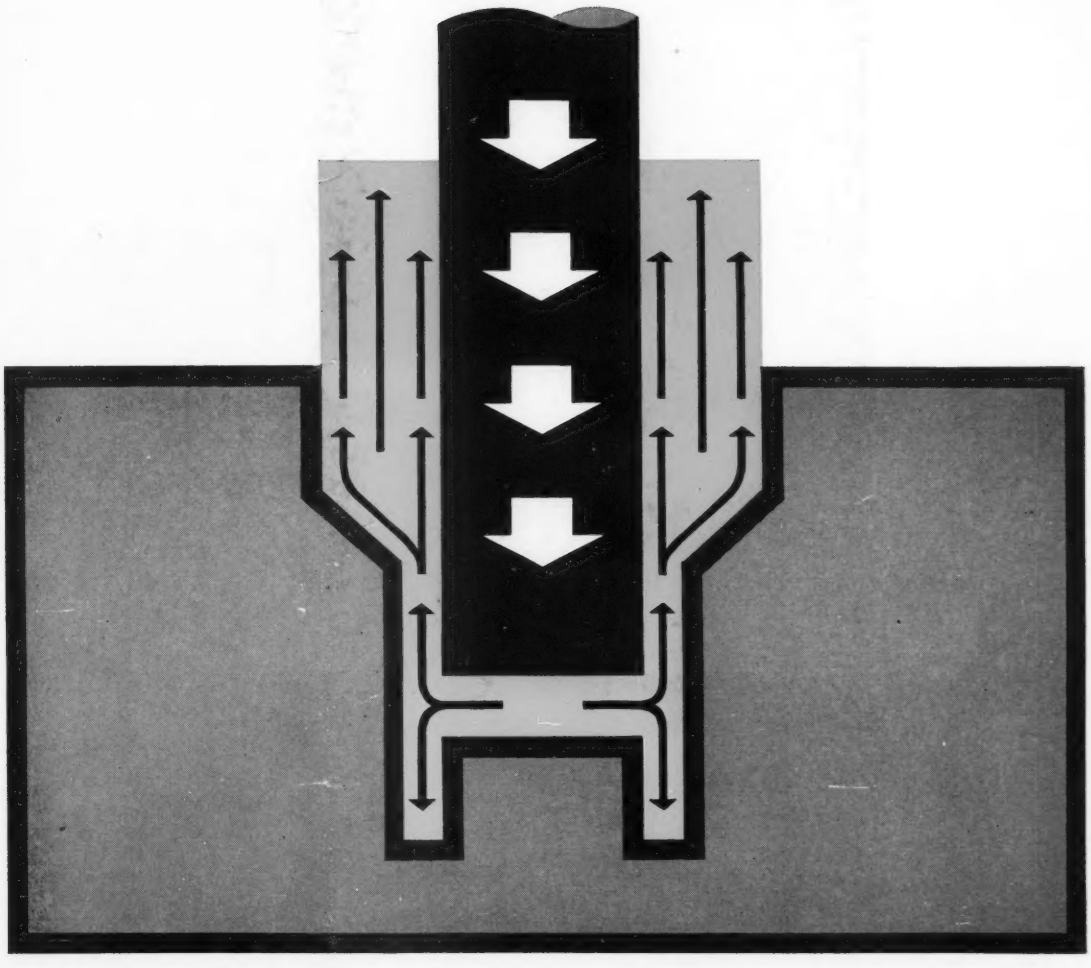


WHEN TO USE COLD EXTRUSIONS of ALUMINUM (page 31)

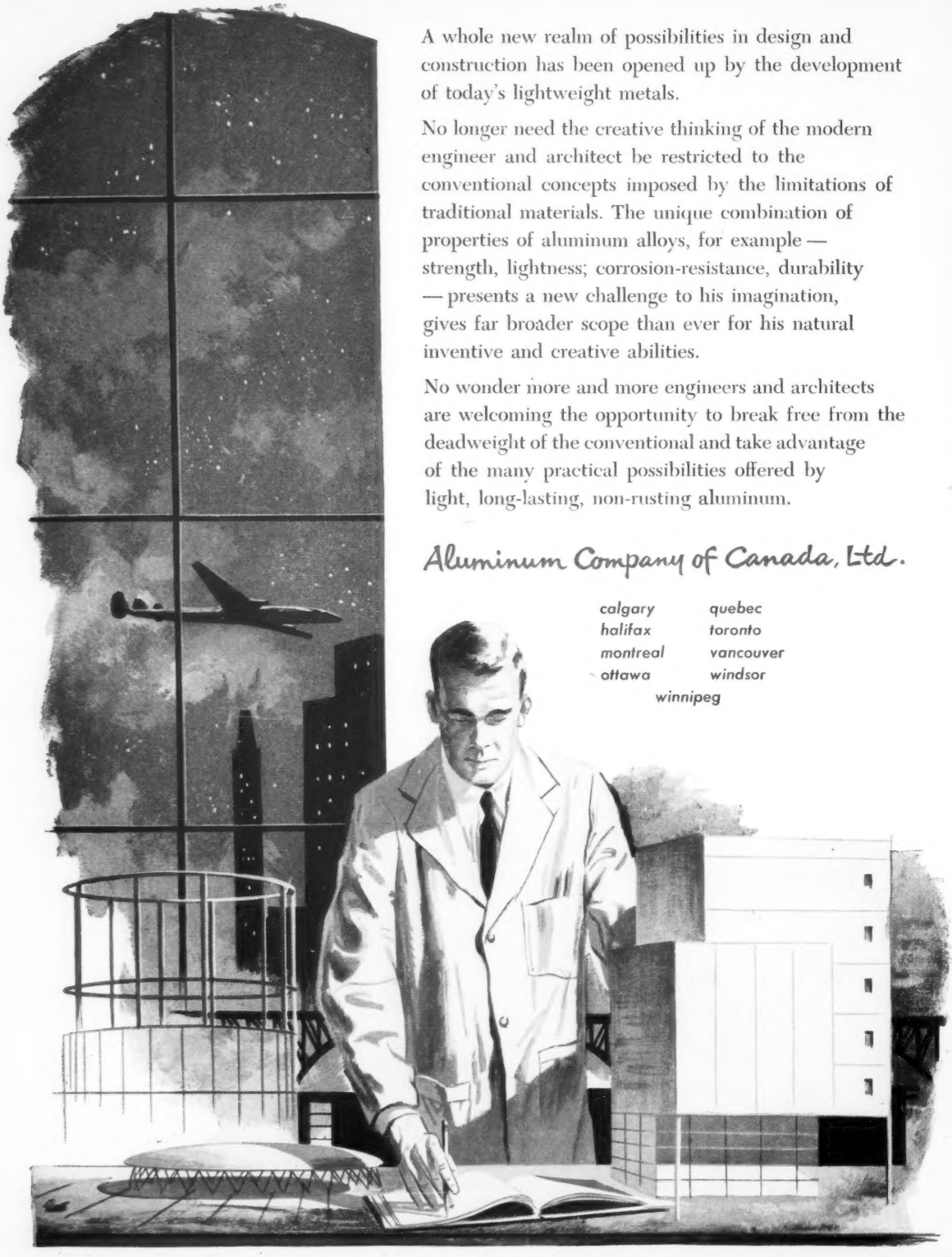
The application of hydraulic packings

November 1956

A report on the I.R.E. Show

PUBLISHED BY MACLEAN-HUNTER PUBLISHING COMPANY, LIMITED, TORONTO, CANADA

Breaking free from the fetters of convention



A whole new realm of possibilities in design and construction has been opened up by the development of today's lightweight metals.

No longer need the creative thinking of the modern engineer and architect be restricted to the conventional concepts imposed by the limitations of traditional materials. The unique combination of properties of aluminum alloys, for example — strength, lightness; corrosion-resistance, durability — presents a new challenge to his imagination, gives far broader scope than ever for his natural inventive and creative abilities.

No wonder more and more engineers and architects are welcoming the opportunity to break free from the deadweight of the conventional and take advantage of the many practical possibilities offered by light, long-lasting, non-rusting aluminum.

Aluminum Company of Canada, Ltd.

calgary *quebec*
halifax *toronto*
montreal *vancouver*
ottawa *windsor*
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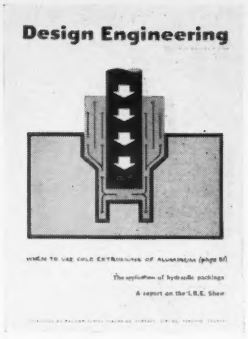

Design Engineering

VOL. 2 **NOVEMBER 1956** NO. 11

This month's cover

Returning to the magazine's cover artist position this month is Desmond English whose fire-engine-red design probably struck your eye. Shown in artistic symbol is a simultaneous forward and backward extrusion taking place. The metal (red) flows two ways in the die (grey) as the punch (black) descends.

Design Engineering

MEMBER

CCAB

Authorized as second class mail, Post Office Department, Ottawa.

Printed and published by Maclean-Hunter Publishing Company Limited, Editorial and Advertising Offices: 212 King Street West, Toronto 2, Canada. Address all correspondence: P.O. Box 100, Toronto, Canada. Horace T. Hunter, Chairman of the Board; Floyd S. Chalmers, President; Donald F. Hunter, Vice-President and Managing Director; Thomas H. Howse, Vice-President and Comptroller.

Publishers of National magazines in Canada: Maclean's, Chatelaine, Canadian Homes and Gardens, Business newspapers in Canada: Canadian Hotel Review; Fountains in Canada; Heating and Plumbing Engineer; Bus and Truck Transport; Canadian Advertising; Canadian Automotive Trade; Canadian Aviation; Canadian Grocer; Canadian Machinery; Canadian Packaging; Canadian Paint and Varnish; Canadian Printer and Publisher; Canadian Shipping; Canadian Stationer; Civic Administration; Drug Merchandising; L'Epicier; The Financial Post; General Merchant; Hardware and Metal; Marketing; Men's Wear; Modern Power; Painting and Decorating Contractor; Plant Administration; Le Prix Courant; Electrical Contractor; Style; Office Equipment & Methods; Home Goods Retailing; Photo Trade; Building Supply Dealer; Business newspapers in U. S. and U. K.: Inland Printer, Rock Products, Concrete Products, British Printer.

OTHER SERVICES: The Financial Post Corporation Service; Canadian Press Clipping Service; Commercial Printing Division.

Offices at 1242 Peel Street, Montreal; Maclean-Hunter Limited, 125 Strand, London (Eng.).

Subscription rates: Canada $5.00 per year, two years $9.00, three years $13.00. Single copy price, $1.00. Other countries $8.00 per year.

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Using

DU PONT ELASTOMERS

NEOPRENE · HYPALON®

in Design

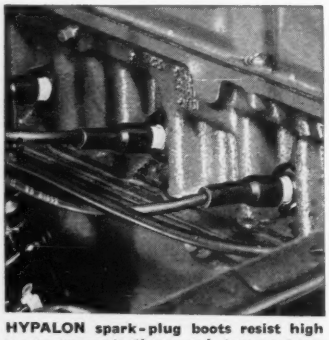
Molded spark-plug boots of HYPALON® withstand ozone and heat (270°F.)

Several years ago a leading car manufacturer set out to find a new rubber material for its spark-plug boots. New designs had increased engine horsepower but at the same time reduced engine space, thus increasing the temperature under the hood. Existing boots couldn't take the punishment of temperatures averaging 270°F. with occasional peaks of 340°F., or the increased ozone concentration caused by reduced space under the hood.

After testing several resilient materials, they decided on Du Pont HYPALON synthetic rubber. HYPALON has exceptional resistance to deterioration at high temperatures and it is virtually ozone-proof. The problem was solved. HYPALON has been specified for the spark-plug boots on this manufacturer's new V-8 and six-cylinder engines.

HYPALON also offers outstanding resistance to weather and oxidizing chemicals. And it can be compounded in an unlimited range of sunlight-stable colors.

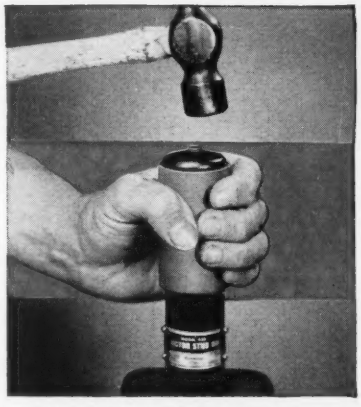
Why not investigate the possibilities of using HYPALON in your designs? We'll be glad to send you complete property data and application information. If you have a specific problem, please let us know.



HYPALON spark-plug boots resist high ozone concentrations and temperatures averaging 270°F., in the engine of one of today's leading cars.

Why Remington uses NEOPRENE on its new model stud driver

Powerful and fast, the new Remington "MIGHTY-MITE" stud driver uses a 22-caliber cartridge to drive ¼" studs in steel or concrete without pre-drilling.



The "MIGHTY-MITE'S" barrel must be twisted and held firmly against the work to expose the firing pin. Neoprene traction grip stands up to grease, oil and perspiration.

Neoprene resists grease, oil and perspiration, assures a firm tool grip

Small contractors and "do-it-yourselfers" are finding the new Remington "MIGHTY-MITE" a handy tool for driving ¼" studs into steel or concrete. Just a hammer tap fires the 22 caliber cartridge, which drives the stud, anchoring wood or steel fixtures in seconds—without pre-drilling.

Design features of Remington's "MIGHTY-MITE" are simplicity and safety. The barrel of the tool must be twisted, then thrust down and held firmly against the work to expose the firing pin. Neoprene was selected for the barrel traction grip because of its resistance to the effects of grease, oil and perspiration. A green neoprene compound was selected because it enhanced the appearance of the finished product.

This is just one application where neoprene has proved its effectiveness. If you need a resilient material with exceptional resistance to oils, greases, solvents, chemicals, abrasion and flex cracking, it will pay you to investigate neoprene. We'll be glad to send you further information —data on properties and proven applications. If you have a specific problem, please let us know.

DU PONT CANADA

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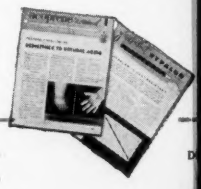

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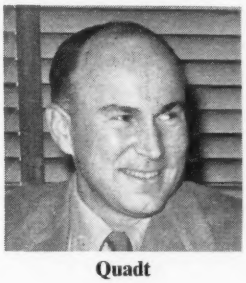
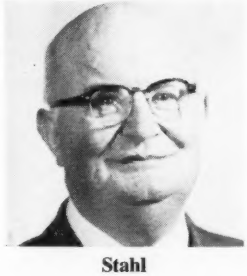
The December issue of **Design Engineering** will carry strong feature articles written by contributors no less experienced than those featured this month.

A unit that almost every design engineer has to specify at some time is the electric motor. Does he really know what to look for apart from a neat exterior? Sometimes not. Our December issue aims to fill this gap with information on the all-important internals. Also slated for the issue are articles on super steels, spray welding, air impellers and skin-diving valves.



Quadt

Raymond A. Quadt is vice-president of Hunter Douglas Aluminum Corp. and director of research. He holds patents for refining aluminum scrap and has developed numerous new aluminum alloys for special purposes. Recipient of the Navy's 1956 Meritorious Public Service Citation, Quadt got the award for work in the rocket field. Off-duty this v-p is to be found flying or at the local golf course.



Stahl

Author of this issue's article on hydraulic packings is **E. P. Stahl** who does sales promotion work for the oil and grease seal department of the Garlock Packing Co. Once a school teacher, Stahl has done work for Buick and for the Hyatt Roller Bearing Co. His principal hobby is the preparation of technical articles for trade papers and (less of a busman's holiday) attending football and baseball.

Dutton

Readers who can remember the electronic survey which appeared in the January issue this year may recall that one of the co-authors was **Ian R. Dutton.** He's back again in this issue with a report and pictures of the recent Canadian IRE Show. Dutton with his dogs in the developer may be seen at left. You see, he spent so long on the concrete floors down at the show that his feet became tired. Having to hustle somewhat to get his article ready for publication, he wrote, bathed his feet and developed his prints simultaneously. Result: a very complete report, good pictures and the best developed pair of ankles in the county . . . so runs the story. Dutton went from high school during the war to the Army where he became first a radar technician and then an instructor. War's end saw him with Canadian General Electric after an electrical engineering degree from Toronto University. He is now with the advertising and sales promotion division of J. A. Wilson Lighting and Display.

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Why Is POLYSAR Used The World Over?

Why is Polysar specified by manufacturers in every continent? Because *there's been a revolution in rubber. Now . . . with Polysar *chemical* rubbers and the help of Polymer's research technicians . . . manufacturers are able to offer products with the superior qualities needed to meet today's exacting requirements.

Whether rubber now enters into your products or not, it will pay you to inquire about the possibilities of Polysar. You'll find—as have manufacturers in 40 countries—that Polysar rubbers can greatly improve present products and enable you to create new ones.

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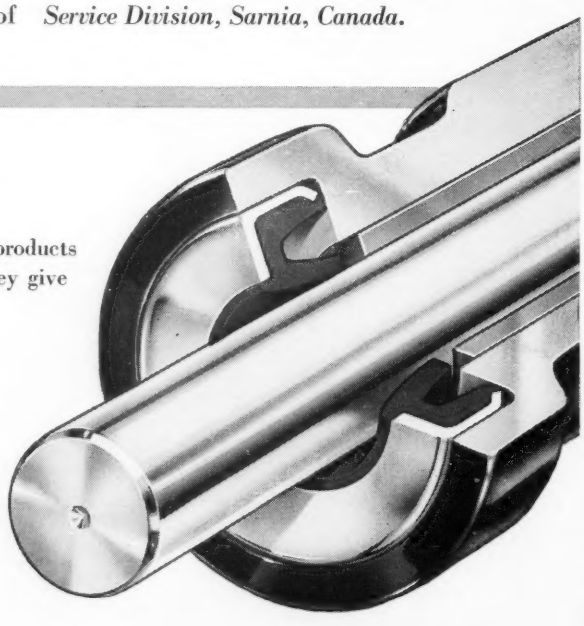

Here's Why POLYSAR Rubber Is Used In Oil Seals

Manufacturers of oil seals and many other products specify Polysar Krynac rubbers because they give the best balance of good processibility, low-temperature properties, oil resistance, and physical properties. For different product needs and applications, Polysar Krynacs are available in four oil-resistant types.

Polysar rubber has improved oil seals—it can improve your products, too.

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Reports

News in brief from the world's producers

The swimming pool reactor

Canadair's general atomic division is currently completing its pool test reactor for Atomic Energy of Canada. This "swimming pool" type of reactor, a Canadian first, is at Chalk River and is to be used for comparative reactivity measurements between known and unknown samples of material. The reactor should be ready by May of next year and becomes "critical" shortly afterwards.

• • •

Union Carbide to build

In a transaction in the region of $1,000,000 Union Carbide Canada Ltd. recently purchased property in Toronto for a head office building. The site is in the Yonge-Eglinton area and the company has plans for a modern building for its head offices and for the executive offices of its five operating divisions.

• • •

Up with the bridge

The permanent raising of the Jacques Cartier bridge in Montreal is a project that will probably be of considerable interest to our readers. The raising operation, which is probably the largest of its kind ever undertaken, is necessary to provide clearance for ships using the St. Lawrence Seaway Channel.

The contract to the Dominion Bridge Co. of Montreal is valued at almost $7,000,000 and is described by the Hon. Lionel Chevrier, president of the Authority, as "one of the most spectacular and complicated works required for the St. Lawrence Seaway."

• • •

New Timken offices

The Timken Roller Bearing Sales and Service Ltd. has opened a new warehouse and offices in Montreal. Clarence Sheppard, sales representative in the Montreal district for the last fourteen years, has been named manager.

• • •

Vertical takeoff aircraft

In a talk to the Kiwanis Club of Victoria Norman Carver, chief quality inspector of Fairey Aviation Co. of Canada, predicted that the advances of the aviation industry over its first fifty years "will pale before the achievements of the next decade." The pilot's role, said Carver, is changing from wrestling aircraft through the air to "becoming a monitor, a safety valve, a thinking machine."

Looking to immediate needs, Mr. Carver said that vertical takeoff aircraft could play a large part in the development of Canada, especially British Columbia, obviating the need for construction of large and expensive airfields.

• • •

TV package station.

British Columbia's first private TV station, CHEK-TV situated in Victoria, commenced broadcasting last month from a combined studio and transmitter location. Manufacture and installation of the equipment was handled by Canadian Westinghouse and included tower, antenna, transmitter and studio equipment.

• • •

Foundry in A. V. Roe group

Since September 1st a new company, Canadian Steel Foundries (1956) Ltd. has been operating the former steel foundry division of Can-Car. It will be another corporate member of the A. V. Roe Canada Ltd. group.

The foundry has a capacity of 4,000 tons of finished castings per month, representing approximately one third of Canada's total capacity.

• • •

Order from Isotope Products

A 15,600 curie cobalt source has been ordered from Atomic Energy of Canada by Isotope Products. It will be used in an irradiation pilot plant which is to be built as one stage of a new radiation service for industry. Design of the plant is now under way by a staff headed by Dr. Louis Voyvodic, director of nuclear projects of Isotope Products. The building will be completed in 1957 in time to receive the giant cobalt source from Canada's NRX reactor.

• • •

That Ferguson car

The veil of secrecy that has been pulled over the new automobile of British designer Sir Harry Ferguson occasionally has its corner lifted for long enough to keep public interest high.

Main differences from the conventional seem to lie in the fields of transmission, braking and traction. Braking without any skidding is reported to be phenomenal and in tests the Ferguson car has been able to pull a loaded trailer over steep slopes that leave the conventional auto helpless.

• • •

Nuclear physics lectures

Engineers in the Hamilton district of Ontario are receiving an insight into the mysteries of the atom and the increasingly important field of nuclear physics through a six-lecture course on atomic energy being sponsored by the Hamilton branch of the Engineering Institute of Canada.

The lectures started early last month and are conducted by Dr. M. W. Johns of McMaster University and Dr. D. M. Roberts of the Canadian Westinghouse atomic energy division.

• • •

Land tug for Canada

A British built "land-tug" is to be tested by the Canadian Government in the far north. Called the "Water Buffalo" it is designed to float in peat mud and to plough through water 4 ft. deep. The vehicle has a watertight hull and rides on flexible rubber tracks. Climbing gradients up to 45 degrees with ease, it has a top speed of 8.5 mph and can carry three tons on the centre hopper and on the side decks which extend over the tracks.

• • •

The ball begins to roll

Seems that the recent National Manpower Engineering Conference has really caused a stir in industry and education, and rightly so. Offers of technical assistance, facilities and pleas to the Government for federal subsidy come from all sides. The St. Andrews Conference can take a bow for getting things off the ground.

• • •

Gold in them thar windshields

A special cold-weather windshield suitable for use in sub-zero weather has been produced by a Scottish firm for a line of excavators on order for Canada. The windshields have a thin gold film applied to them through which an electric current passes. This heats the surface of the glass to prevent icing.

• • •

Supercharged diesels

Supplementary to the article on diesels in this issue we have the information that a British firm has now produced a diesel primarily for export to Canada. Available for automotive, industrial or marine use, the new engine has been designed to give heavy vehicles high speeds. It develops 185 bhp at 1,900 rpm.

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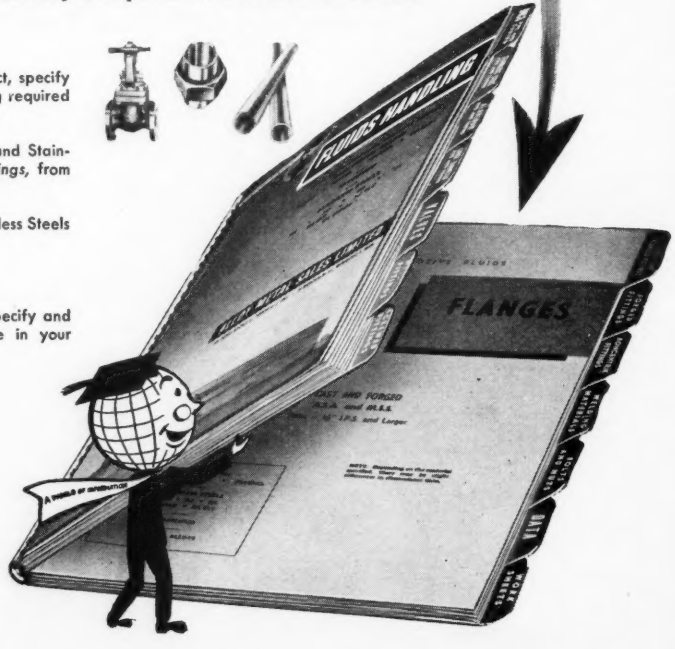

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...helps Supreme Aluminum develop new pot handle with five important advantages

- **Remains cool**
- **Stainless**
- **Easy-to-clean**
- **Comfortable to hold**
- **Attractive**

Canadian General Electric's Plastic Engineers were able to solve a plastics-to-metal bonding problem in the development of a new pot handle for Supreme Aluminum.

This is just another example of how the experience and facilities of C.G.E.'s Cobourg Plastics Plant have "paid off" for customers.

Solving production problems like this is typical of the kind of service that brings repeat orders time after time from C.G.E.'s customers.

Canadian General Electric offers you complete facilities at Cobourg for every type of plastics molding—injection, compression, extruding and automatic. Call on C-G-E plastics engineers and technicians whenever a new problem or the need for a new product arises. For further information contact: Plastics Advisory Service, Canadian General Electric Co. Ltd., Cobourg, Ontario.

CUSTOM MOLDED PLASTICS

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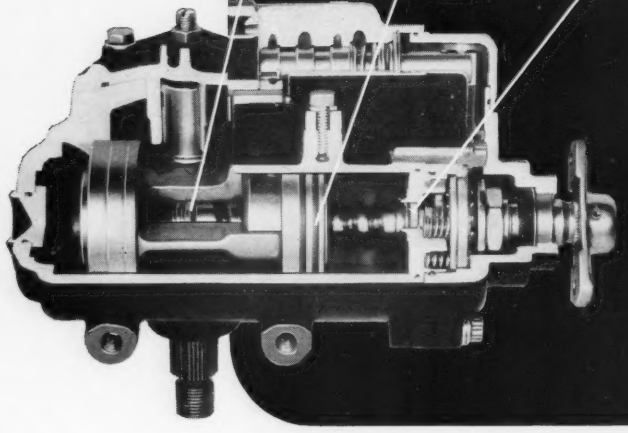
CANADIAN GENERAL ELECTRIC COMPANY LIMITED

MORE OF THE GARLOCK **2,000**

Garlock Teflon* Seals help make power steering easier



The low coefficient of friction and longer service life of Garlock Teflon seals has been used to great advantage by a large producer of power steering equipment. The switch to Teflon substantially reduced both manual turning effort and wear in the power steering mechanism.

These seals were designed by Garlock engineers to do a particular job better. They are typical of "the Garlock 2,000" . . . two thousand different styles of packings, gaskets, and seals to meet every conceivable need . . . the *only* complete line available. That's why your Garlock representative can give you *unbiased* recommendations. Call him at the start of your next project, his experience will save you time and money. Write today for new Garlock Teflon Catalog AD-155.

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For the finest metal surface treatments, plus all these advantages, call in the Parker man in your territory.

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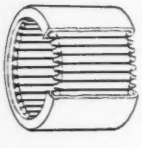
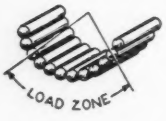
corrosion resistant paint base	aids in cold forming of metals	rust resistant	wear resistant for friction surfaces	heavy duty maintenance paints since 1883

TORRINGTON

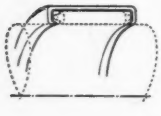
DC needle bearings give high-capacity performance in minimum space



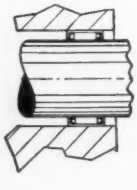
Unique construction—accurately drawn, surface-hardened shell retains rollers and serves as outer raceway.



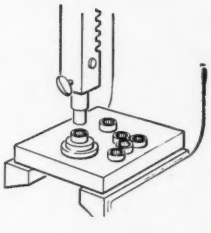
Full complement of small diameter rollers—precision-ground and through-hardened—assures top capacity by distributing load over large number of contacts.



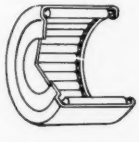
Turned-in lips of the case-hardened outer shell keep dirt and grit out, lubricants in—while retaining trunnion ends of rollers. All wear surfaces of outer race are case-hardened.



No inner race required on surface-hardened shafts—reduces space requirements, lowers unit costs.



Simple assembly—arbor press seats bearing in round housing bore. No collars, shoulders or retaining rings needed.



Closed end type DC Needle Bearings are available for stub shaft applications. The closed end provides a perfect seal at no extra cost.

Needle Bearings are made in a Precision Series for most applications and an Extra Precision Series where low radial play and minimum eccentricity are required. Easy lubrication through optional hole in shell or through hole in shaft assures long service life. Bearings can be pre-packed with suitable grease for those applications requiring grease lubrication.

See our new Needle Bearing Catalog in the 1955 Sweet's Product Design File—or write direct for Catalog No. 55.

THE TORRINGTON COMPANY
925 Millwood Road, Toronto 17, Ont.

District Offices and Distributors in Principal Cities of United States and Canada

TORRINGTON BEARINGS

THE TORRINGTON COMPANY 90th ANNIVERSARY 1866–1956

Needle • Spherical Roller • Tapered Roller • Cylindrical Roller • Ball • Needle Rollers

New Farval spray panel lubricates gearing automatically, efficiently, inexpensively

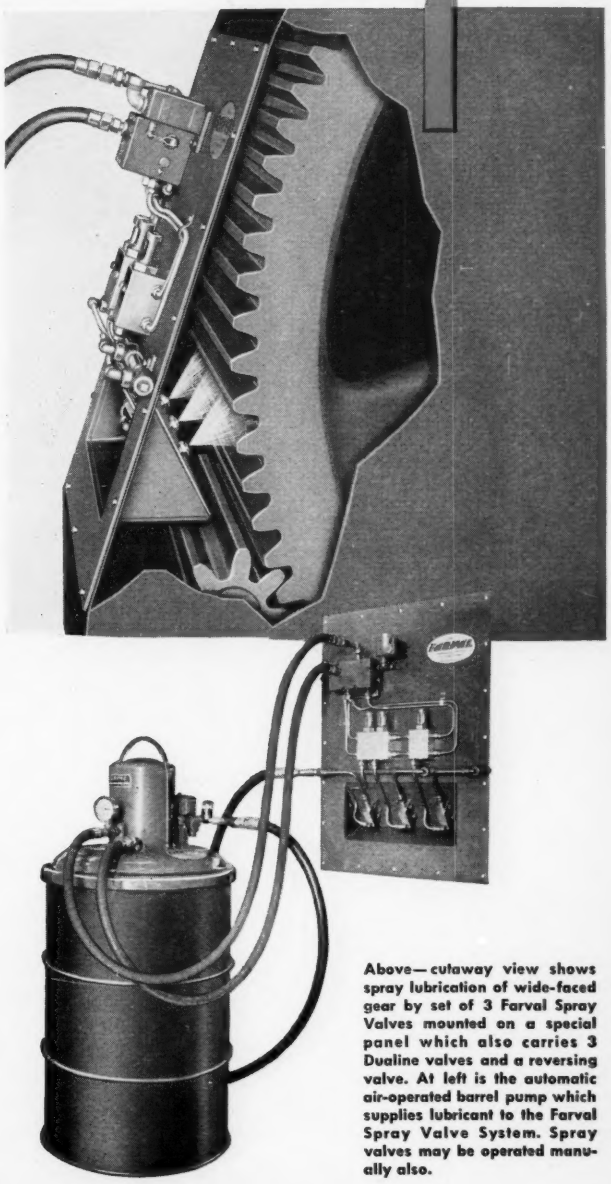
FARVAL—
Studies in Centralized Lubrication
No. 183

HERE'S how to do a better job of greasing gears and save a lot of lubricant and labor besides. Just install Farval Spray Valves. They can reduce oil and grease consumption and oiling labor as much as 95%. Then you can throw away the oil can and grease bucket, and put your oilers on other constructive work.

Shown at right is a new Farval Spray Valve System developed for large-diameter wide-faced gears. Installed on a panel mounted on the gear housing are Dualine valves, spray valves and reversing valve. An automatic air-operated barrel pump supplies the lubricant.

Farval Spray Valves are completely flexible as to arrangement and operation. They can be used alone or as part of a Dualine System—wherever a supply of compressed air is available. As with standard Dualine valves, the spray can be operated as often or as infrequently as needed to deliver any desired amount of oil or grease, on gears, sliding bearing surfaces or other areas needing lubrication. There is no waste or mess. Quantity of air used is limited to the exact amount required to spray each delivery of oil or grease.

Hundreds of Farval Spray Valve Systems are now in use in many industries. Why not investigate this simple, inexpensive method for your own plant equipment? Tell us the type of gearing or machines for which you would consider automatic spray lubrication. One of our field representatives will be glad to recommend the Farval system best suited to your needs. Write for Bulletin 26-R. Peacock Brothers Limited, P. O. Box 1040, Montreal 3, Quebec. Branch offices in Sydney, Toronto, Sudbury, Winnipeg, Edmonton, Calgary and Vancouver.



Above—cutaway view shows spray lubrication of wide-faced gear by set of 3 Farval Spray Valves mounted on a special panel which also carries 3 Dualine valves and a reversing valve. At left is the automatic air-operated barrel pump which supplies lubricant to the Farval Spray Valve System. Spray valves may be operated manually also.

FARVAL
CENTRALIZED SYSTEMS OF LUBRICATION

Sold in Canada by . . .

PEACOCK BROTHERS LIMITED

Sometimes it's too late to change your mind!

When a product is shipped with an inferior spring it's often too late for the manufacturer to save his customers' goodwill . . . for in any machine or appliance where you find a spring, you find motion . . . and when that inferior spring breaks down, that motion stops and the manufacturer of the product (not the spring maker!) is blamed.

We suggest you guarantee your product's good name by always specifying Wallace Barnes *quality* springs . . . known the world over for their precision and long life.

FREE BOOKLET

SPRING CHATS will keep you as informed as your competitors about new spring advances. Issued five times yearly, this booklet is packed with spring facts . . . not a lot of sales talk. A letter or penny postcard with your name and address is all that is needed.

WALLACE BARNES CO.LTD.

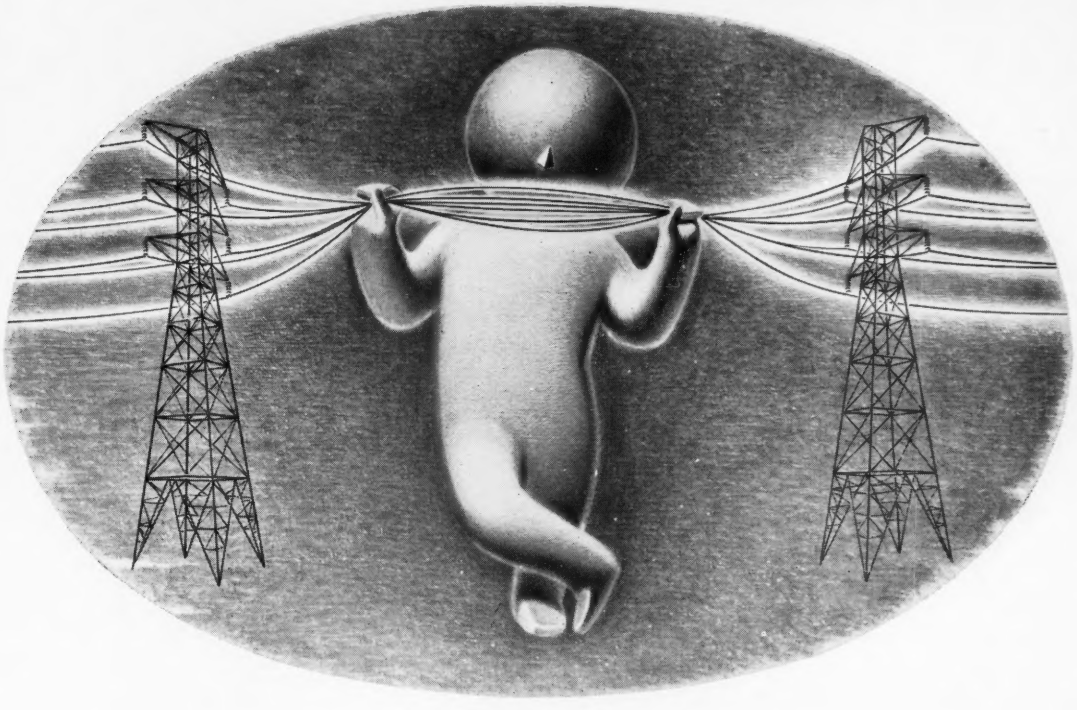
DEPARTMENT I-35 HAMILTON, ONT.

64-171

How can you benefit from the amazing

ELECTRICAL PROPERTIES

of G-E silicone rubber AT HIGH TEMPERATURES?

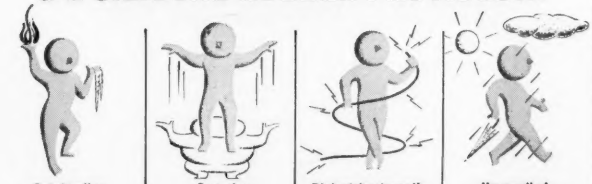


Amazing electrical properties at high temperatures are among the outstanding characteristics of General Electric silicone rubber. It is ideal for wire and cable insulation where overloads or space limitations dictate a heat-resistant dielectric. Cables have been redesigned with G-E silicone rubber to carry nearly *twice the current—with no increase in size!* G-E silicone rubber not only provides Class H insulation, but can be used to improve Class B insulation as well.

Where can YOU use G-E silicone rubber? There's a kind for almost every requirement, classified according to dominant property for easy selection and specification. For example: Class 300 offers the best recovery after compression *of any known rubber!* Class 500 provides flexibility *at 130°F below zero!* Which class is best for *you?*

SEND FOR A FREE
"LIGHTNING SELECTOR"—TODAY!

G-E SILICONE RUBBER PROVIDES...



Outstanding resistance to extreme temperatures

Superior resistance to compression set

Dielectric strength stable at high temperatures

Unequalled resistance to aging, ozone, weathering

Chemical Material Sales

CANADIAN GENERAL ELECTRIC COMPANY
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Chemical Material Sales
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Please send me technical data on G-E silicone rubber, including a free "Lightning Selector".

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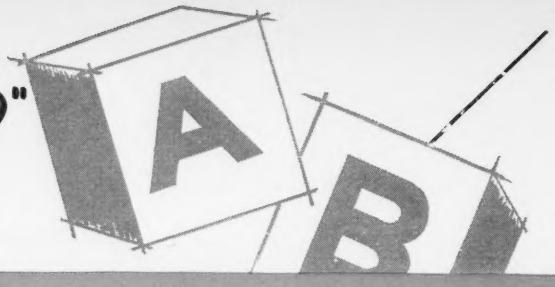
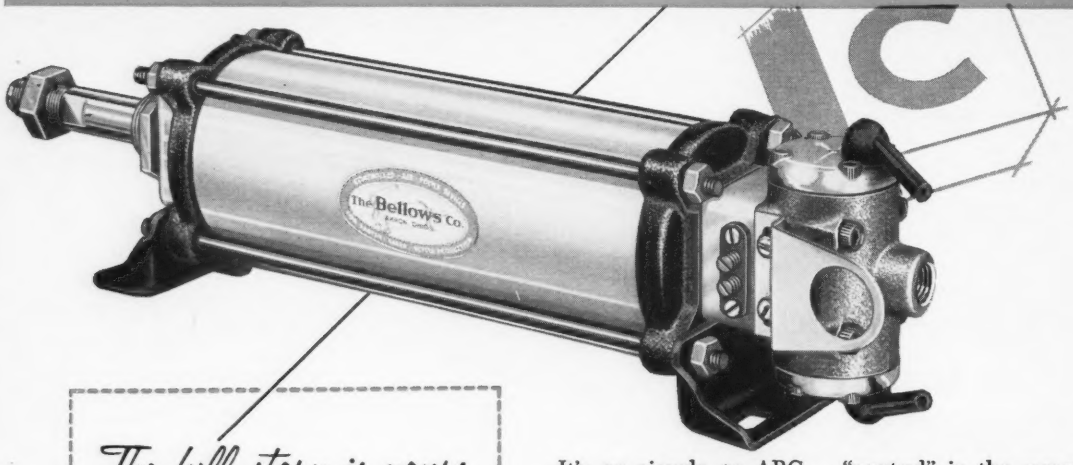
Tops in "CONTROLLED" Air Cylinder Power



The BELLOWS AIR MOTOR



The full story is yours for the asking—

Write for this free new booklet. Bulletin BM-25 gives detailed data and specifications that will enable you to decide for yourself how Bellows Air Motors will save you time and money.

Address Dept. DE 1156, The Bellows Co., Akron 9, Ohio.

In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ont.

It's as simple as ABC — "control" is the essential difference that makes Bellows Air Motors do a better job at lower cost than conventional air cylinders.

In Bellows Air Motors control is an *integral part of* the air cylinder. There are no extra valves to buy — no complicated and cumbersome piping to install. The Bellows Air Motor is a complete power unit in itself.

What does it mean in terms of

- **BETTER PERFORMANCE?**
- **GREATER ECONOMY?**

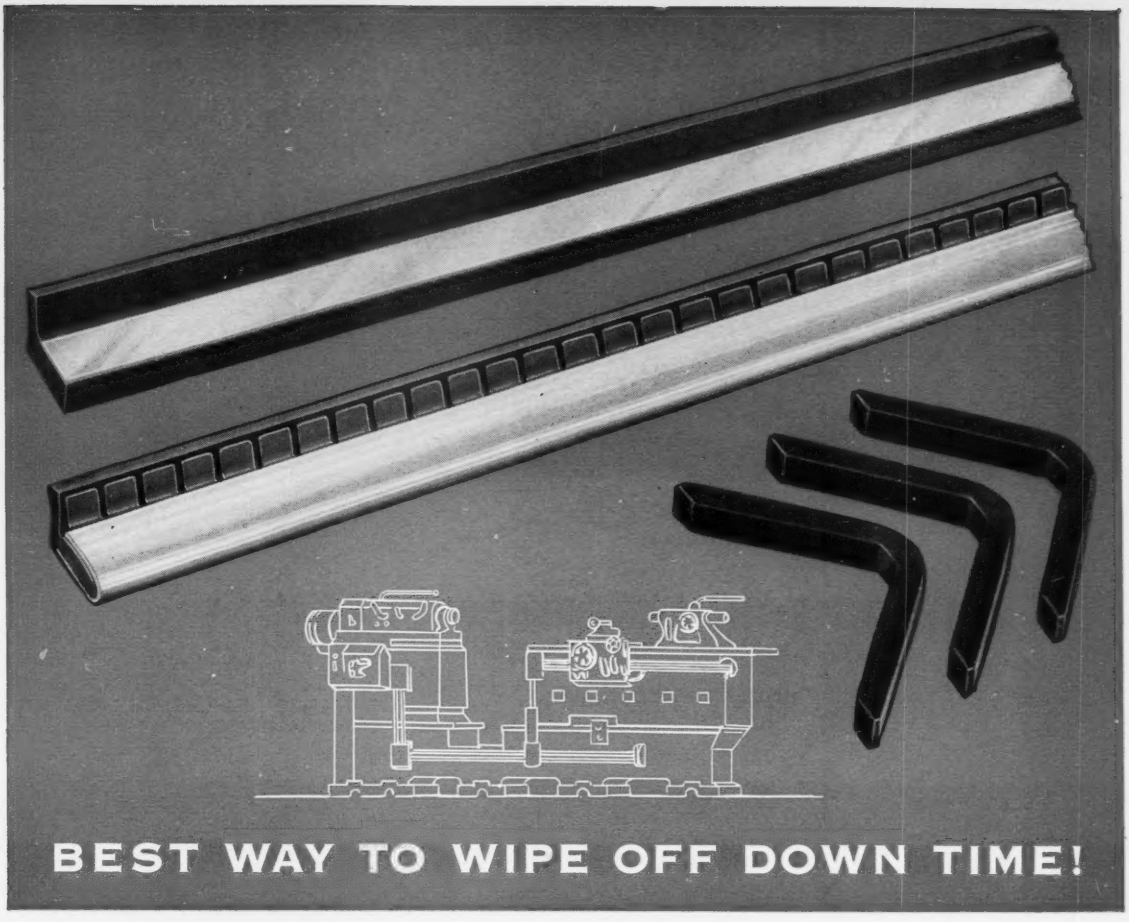
It means instant action. The moment you shift the valve (either electrically or mechanically) the piston responds. No hesitancy — no chatter — no delay. It means simpler installation, easier interlock; "Controlled-Air-Power" fits in naturally with related machine movements. It means lower installed cost — lower maintenance costs.

618-B

Bellows

PNEUMATIC DEVICES OF CANADA, LTD.

14 Advance Road *Toronto, Ontario*



SPECIFY SIRVENE

There are lots of reasons why so many leading machine tool builders agree on Sirvene wipers. You'll find them tops in design, quality and service.

Sirvene wipers are molded as precisely as the setting on a lathe. They must be . . . to exclude fine abrasives and chips, water emulsions or other corrosive materials from bearings. Another reason is their broad resistance to oils, chemicals, solvents, temperatures, abrasion and wear. New metal face and metal cased wipers furnished 22″ long with smudge-free, grey synthetic rubber.

Whether you require wipers of standard or special designs for critical service, investigate Sirvene. You'll find the unmatched experience of C/R Sirvene engineers of great help in meeting your specifications.

GET the basic information on this versatile material. "Engineering with Sirvene" will be sent on request at no charge.

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SCIENTIFICALLY COMPOUNDED ELASTOMERS

MADE IN CANADA

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A DIVISION OF SUPER OIL SEAL MFG. CO., LIMITED

Other **C/R** *Products*

OIL SEALS: Shaft and end face seals for all types of lubricant retention and dirt exclusion • Rawhide hammers and mallets

THE SURPRISINGLY VERSATILE

HEIM Unibal

HAS MANY USES OTHER THAN STRICTLY ROD END APPLICATIONS

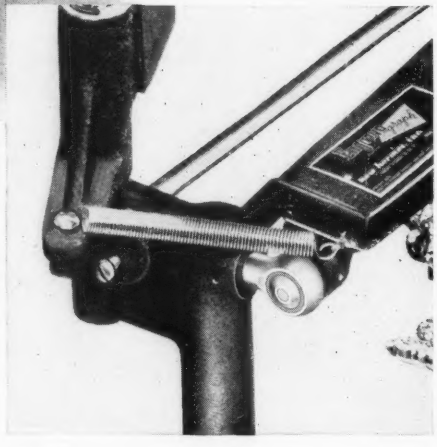
When a Rod End is **Not** a Rod End . . .

The Heim Unibal Rod End was originally designed to act as a self-aligning bearing terminal for push-pull rods. As a spherical bearing rod end, it has universal application and has solved many a linkage problem.

Many manufacturers discovered the versatility of the Heim Rod Ends and how inexpensively they could be applied as self-aligning supports for shafts, as superior pillow blocks, and as take-up bearings.

One example of how perfectly the Heim Unibal Rod End can be used for other than a push-pull linkage, is the New Hermes Engravograph, a machine for engraving watches, jewelry, silverware, and other articles with irregular surfaces.

Here two male rod ends are screwed into the casting to support the engraving arm. The rod ends make possible a smooth, dependable motion which compensates for misalignment and unevenness caused by irregularity of the working surface.



The male rod end is attached by drilling a hole in the work, tapping for proper thread fit, and screwing in the rod end.

The female rod end may be attached by drilling a hole in the work and drawing the rod end tight with a machine screw.

SEND FOR THE COMPLETE HEIM CATALOG NO. 100

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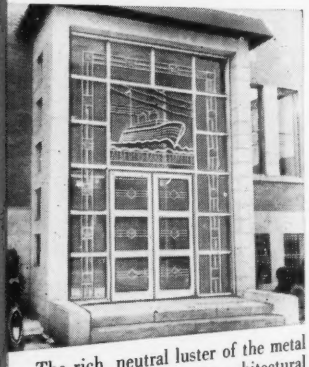
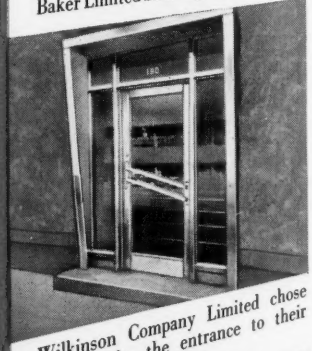
LONDON, ONT. 1024 Oxford St. East
HAMILTON 130 Ferguson Ave. N.

FACTORY REPRESENTATIVES AND DISTRIBUTORS FOR CANADA

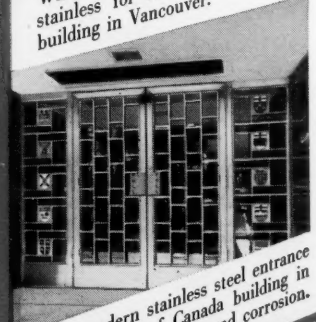
Entrance to the Fairbanks-Morse building in Winnipeg.



The rich, neutral luster of the metal contributes to handsome architectural effects as illustrated in the Albert G. Baker Limited building in Quebec City.



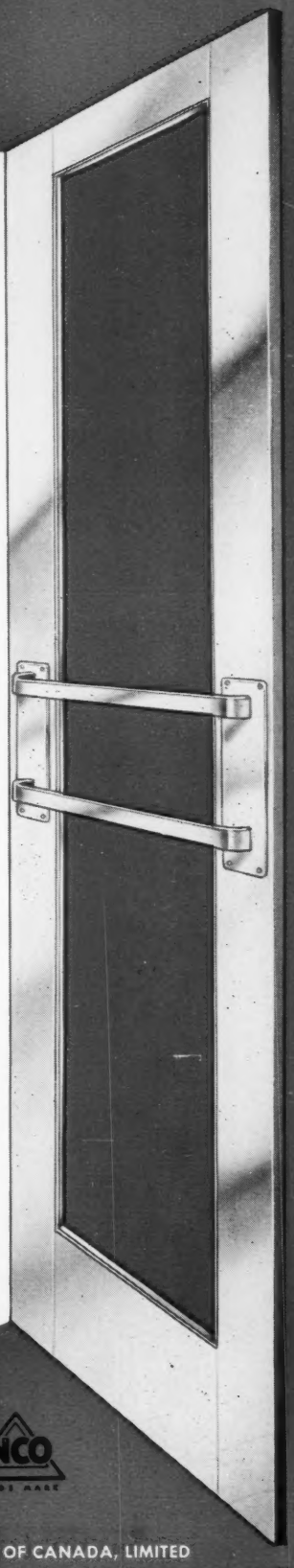
Wilkinson Company Limited chose stainless for the entrance to their building in Vancouver.



This modern stainless steel entrance to the Bank of Canada building in Winnipeg resists rust and corrosion.

From coast to coast... entrances to be proud of...

...with nickel-containing stainless steel



THE RICH, NATURAL BEAUTY OF STAINLESS IS LONG LASTING—ECONOMICAL TO MAINTAIN

Architects and designers have found that stainless steel is an enduring construction material that does not deteriorate with age and exposure. Stainless is easy to keep clean, cuts maintenance time and costs. But, above all, stainless steel is a decorative material that gives buildings grace and dignity . . . pleasing and unobtrusive beauty.

INCO
TRADE MARK

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED
25 KING ST. W., TORONTO, ONT.

"3M" Coating EC-244 is used to protect underground manifold piping, valves, etc., against soil corrosion.

"3M" Sealers are widely used in the aircraft and automotive industries.

"3M" Adhesive EC-770 being applied to the inside edges of hot air register for bonding a felt strip gasket.

Applying "3M" vinyl protective coating to a part of an offshore drilling rig.

Solving the problems of design /

'3M' offers 1000 different types of adhesives, coatings and sealers

There is virtually no limit to the number of materials that can be joined, coated or sealed with "3M" Brand Adhesives, Coatings and Sealers. Wood, plastics, rubber, glass, leather, metal and many other types of materials, which once were joined with mechanical fasteners, are now being held firmly and permanently with "3M" Brand Adhesives. These same materials can be protected or insulated with "3M" Brand Coatings. Gaps and voids can be closed, metal components separated to avoid galvanic corrosion, by the use of "3M" Brand Sealers. When it's a question of adhesives, coatings or sealers—consult your "3M" representative for complete information.

3M COMPANY **ADHESIVES, COATINGS, SEALERS**

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Sales Offices: **Halifax • Montreal • Toronto • Winnipeg • Saskatoon • Calgary • Vancouver**

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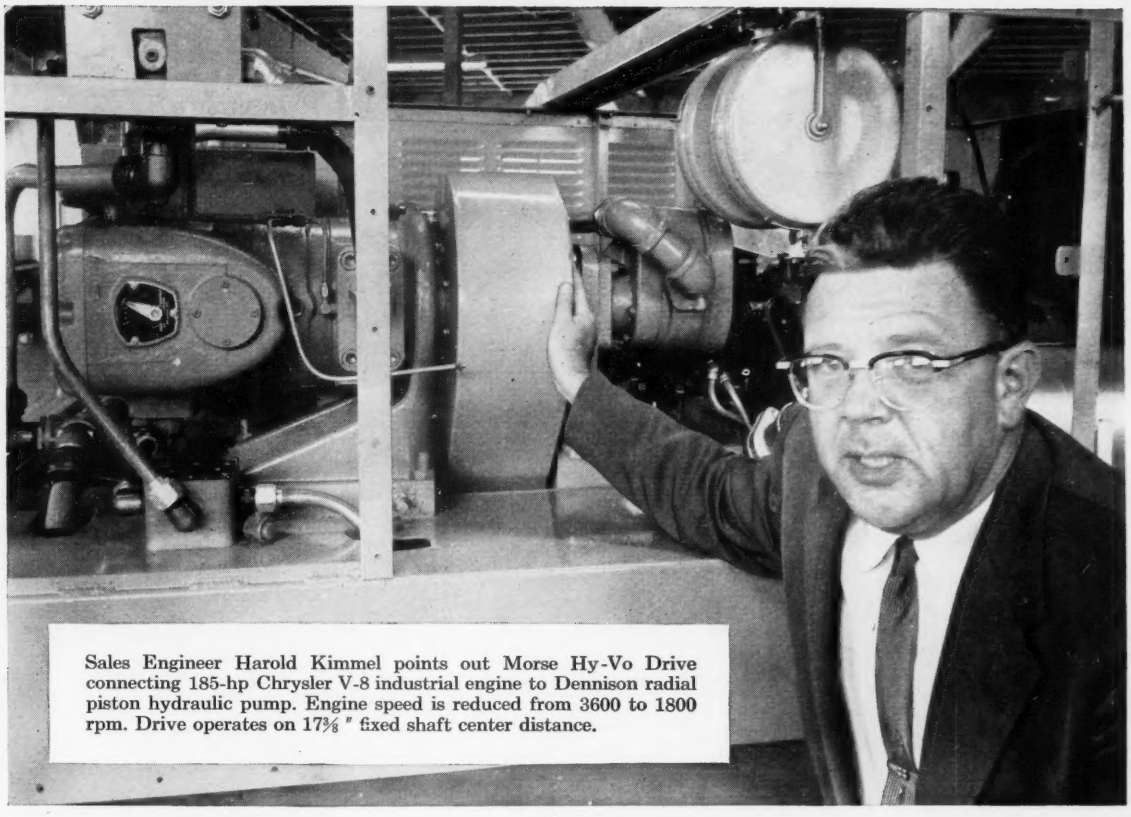
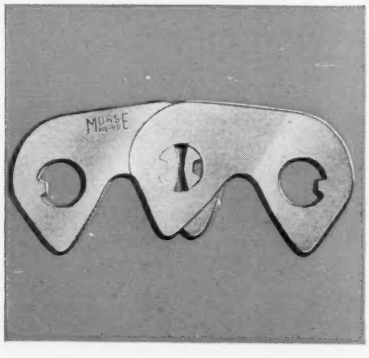
Morse HY-VO Chain offers designers high-hp capacity; space and cost savings



Sales Engineer Harold Kimmel points out Morse Hy-Vo Drive connecting 185-hp Chrysler V-8 industrial engine to Dennison radial piston hydraulic pump. Engine speed is reduced from 3600 to 1800 rpm. Drive operates on 17⅜" fixed shaft center distance.



Morse Hy-Vo's exclusive rocker-joint design and freedom from chordal action reduce wear and friction, eliminate stretch, and permit fixed shaft centers.

Narrow Hy-Vo Drive transmits power smoothly, efficiently at 6,250 fpm in new jet-engine starter.

In building the Pre-Flight Equipment Jet Hydrostarter, the basic design problem was to find a compact, efficient method of transmitting power from the primary motor to the pumps which actuate the hydraulic starting motor. In addition to providing a 50% speed reduction, the power transmission unit had to withstand reactive shock loads up to 100 hp, occurring each time the jet fuel is ignited.

The solution was a stock Morse Hy-Vo Drive only 3" wide. This compact unit proved to be the most economical method of transmitting the required HP at high speed in the limited space.

Hy-Vo Drives are built for maximum-load-carrying capacity per inch of width at both high and low speeds. They provide smooth, efficient power transmission at speeds up to 8500 fpm.

Call or write for complete information and engineering assistance on Morse Hy-Vo Drives. **MORSE CHAIN OF CANADA LTD. SIMCOE, ONTARIO.**

MORSE MORSE B-W BORG-WARNER *Trademark **POWER TRANSMISSION PRODUCTS**

ASSIGNMENT:
adapting electronic principles to industry

TARGET:
your operations

OBJECTIVE:
production improvement

SPERRY

experience fits into your plans

For many years the research and engineering abilities of Sperry of Canada were necessarily channelled towards the designing and building of vital equipment for defence purposes . . . radar, fire control systems, guided missiles, navigational equipment for aircraft and ships, etc.

This experience and ability is now being put to work in Canadian industry for application on such varied problems as nuclear reactor control, textile and paper machine control, machine tool automation and industrial computers.

*It will pay engineers to investigate opportunities at Sperry by contacting the Chief Engineer.

Experience is the keynote of Sperry of Canada's ability to solve your problems.

EXPERIENCE TO PLAN
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ABILITY TO BUILD

SPERRY GYROSCOPE COMPANY OF CANADA, LTD.
P. O. BOX 710 MONTREAL, QUE.

The continuing development of new alloys

For many years, the aeronautical industry has made extensive use of nickel-bearing materials—at first because of strength requirements (i.e. landing gear steel) and then for specialized applications such as exhaust manifolds, where high temperature properties of Inconel* are giving outstanding service.

JETS SPUR DEMAND

With the development of the jet engine, the use of high-nickel-containing materials really came to the fore, these alloys being used in such essential components as blades, wheels and flame tubes.

NEW ALLOYS DEVELOPED

The development of the high-nickel blade alloys to parallel gas turbine improvements illustrates how Inco has met immediate problems and how effort is being put forth to better its alloys of the moment. Blades for Canada's first jet aircraft engine were of Inconel "X"*. As the engine improved a new alloy, designated as 550—a modified type of Inconel "X"—was produced to meet more severe requirements. At the moment there is Alloy 700—a new type of material with excellent properties at elevated temperatures. *And the search is continuing for better alloys.*

TURBINE WHEEL MATERIALS

The same story holds true for the development of turbine wheel materials. Here, the alloy currently being offered is designated as Alloy 901. This material also has promise in the rolled condition and should find application when elevated temperature properties are required in both engine and airframe construction.

U.K. OPERATION

Nimonic alloys produced by our affiliate Henry Wiggin & Company, Limited, in the United Kingdom, have found wide acceptance in aircraft components operating at elevated temperatures. Here, too, the story has been one of continual development of new alloys in order to meet designer demands.

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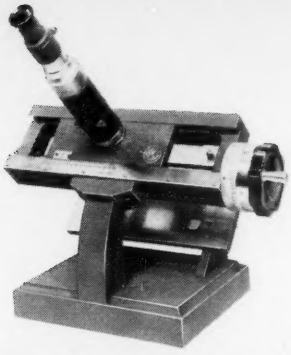
STAINLESS STEEL
CASTINGS

Shawinigan Chemicals makes a wide range of stainless steel castings — large or small, simple or intricate. Regardless of size or type of stainless steel, Shawinigan will turn out the castings needed to handle YOUR heat or corrosion problem.

Our Technical Staff will assist you gladly.

SHAWINIGAN CHEMICALS LIMITED
STAINLESS STEELS & ALLOYS DIVISION

HEAD OFFICE: SHAWINIGAN BUILDING, MONTREAL — — — PLANTS: SHAWINIGAN FALLS



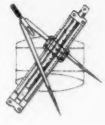
MICROMETER SLIDE (Mounted)
A measuring gauge that may be used with a microscope to provide linear measurements—direct readings to .0001". This instrument is also available with a metric scale; vernier reading to .001 mm. The slant stand is equipped with mirror for reflex illumination.

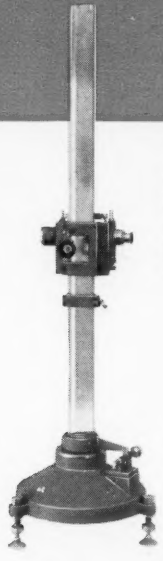
CONTOUR PROJECTOR
A bench type optical comparator which projects an accurate contour on to an 8" screen, to any predetermined magnification. The precision-ground table has a horizontal travel of 8", vertical travel of 2½"; measures helix angles to 12°.

ANOTHER FIRST BY PSC APPLIED RESEARCH LTD.

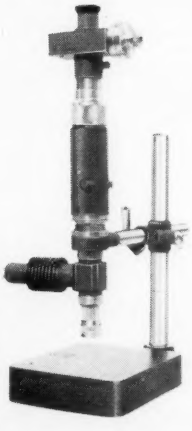
Precision Measuring Instruments

of Canadian Design and Precision Manufacture





CATHETOMETER
An optical height gauge for vertical measurements, accurately reading to .1 mm. at distances up to 10 ft. The scale is also available graduated in inches. This device has a measuring range of 75 cm.; telescope magnification—15x.



MEASURING MICROSCOPE AND ACCESSORIES
A test base with a measuring microscope. A vertical illuminator may be used when slide illumination is not adequate. The Filar Micrometer eyepiece makes possible measurements of objects to .001".

PSC Applied Research Limited, for the first time in Canada, offers extremely accurate, optically assisted, physical measuring instruments of Canadian design and Canadian precision manufacture. Backed by the reputation of one of Canada's most progressive engineering and production companies, these measuring instruments are available now to all fields of industry. Literature and quotations on request. In the Western Provinces, please address enquiries to: Physical Measurements Company Limited, 1438 Erin St., Winnipeg 3, Manitoba.

All other enquiries:

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CONTROLLED PRESSURE AT 100,000 PSI!

Superior super pressure quality tubing has been used to handle internal pressures from 15,000 to 100,000 psi—offers high fatigue strength, chemical resistance and burst pressure to spare

Safe and efficient service at extremely high pressures makes Superior super pressure tubing preferred for hydrogenation process equipment, high pressure autoclaves, and pilot plant installations in chemical and oil refining plants.

Superior produces this tubing from specially selected raw materials which have had the inside surfaces conditioned to remove fissures and other defects. In processing, special degreasing operations are performed on the tubing, and the inside diameters are sand blasted to insure a clear, smooth surface.

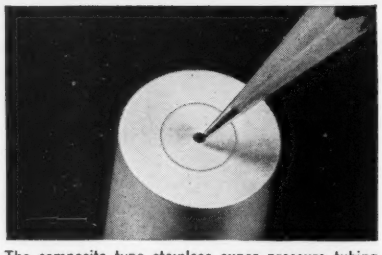
Two types of Superior super pressure tubing are available: a single wall mechanical tubing and a double wall, or composite unit, made from two thinner tubes.

Super pressure tubing is produced in an annealed condition and in ⅛ hard temper, and to mechanical properties specified by the customer.

This tubing is offered in the austenitic stainless steels, Types 304, 316, 321 and 347 and in AISI 4130 alloy steel. It is produced in sizes ⅛″ OD x 1/16″ ID up to ¾″ OD x 1/16″ ID. Minimum order quantity for mill production is 50 ft. per size and analysis.

Superior rigidly inspects all super pressure tubing for defects such as fissures by visual and microscopic inspection methods. Each length is hydrostatically tested to 5000 psi—upon request, up to 60,000 psi.

If you have a tubing problem in high pressure processing—or of any other nature—call on Superior. Write Superior Tube Company, 2011 Germantown Ave., Norristown, Pa., for Data Memorandum 22.



The composite type stainless super pressure tubing offers the advantage of having the inner and outer tubes independently worked to mechanical property requirements and of different alloys being combined for strength and corrosion resistance.

SUPER PRESSURE TUBING MINIMUM BURSTING PRESSURES FOR AUSTENITIC STAINLESS STEELS AND 4130 ALLOY STEELS

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⅛	*97,200 84,400			
¼	*40,200 34,800	82,000 71,000		
½	*17,400 15,000	33,500 29,100	62,500 54,000	
⅝	*13,600 11,800	25,000 21,600	47,600 40,300	72,600 63,000

*Top figures all Austenitic Stainless Steels
Bottom figures all 4130 Alloy Steels

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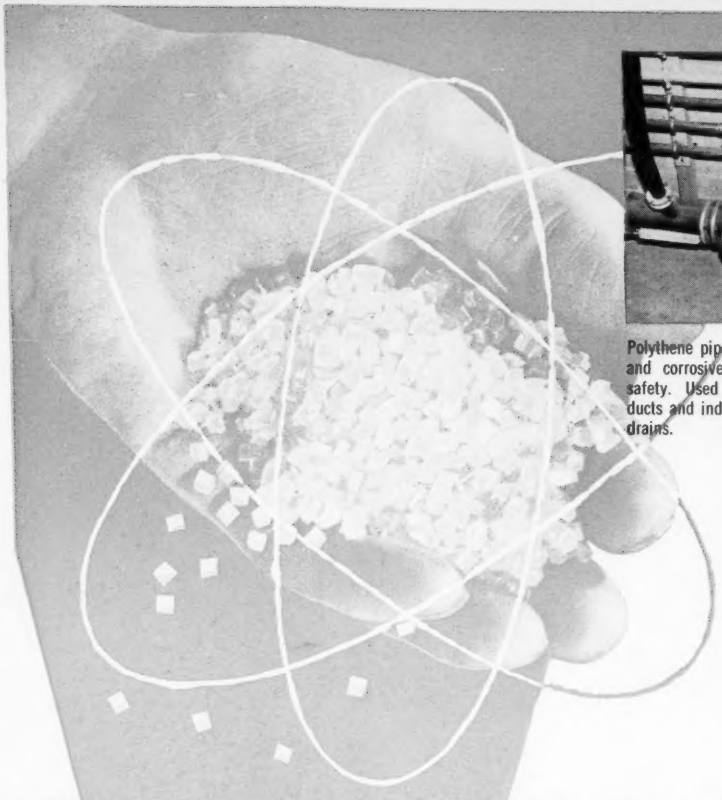

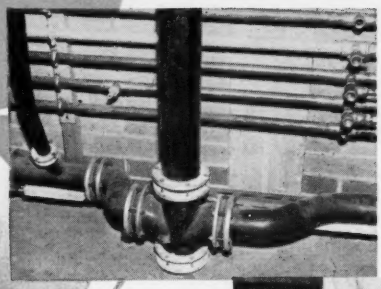

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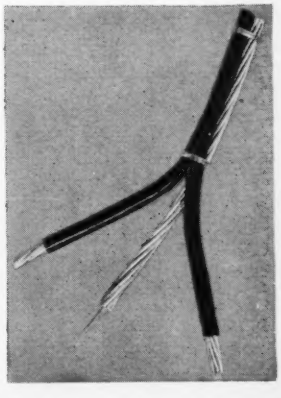

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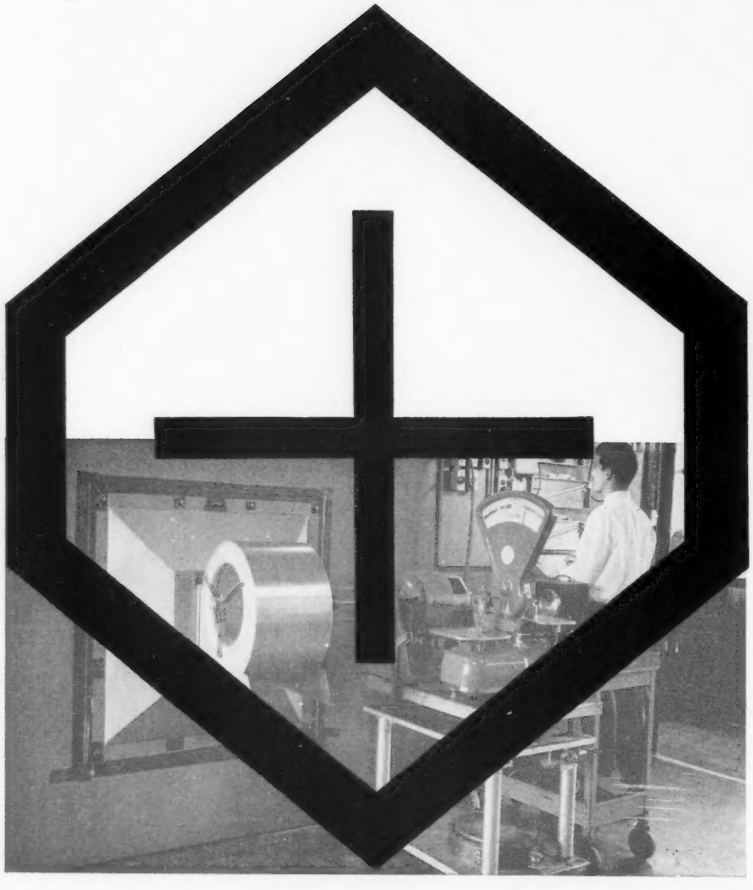

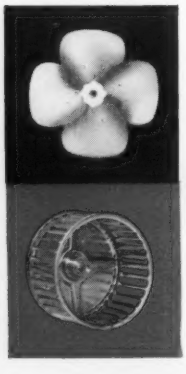

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People

Important people who are in the news

Field Rep for Ontario engineers

An increase in membership and the expansion of engineering activities has resulted in the appointment of **Blakeley H. Goodings, P.Eng.,** as field representative of the Association of Professional Engineers of Ontario. Working from Toronto, Goodings will provide the liaison link between the Association and industry throughout the province.

The Association's new representative is a mechanical engineering graduate from the University of Toronto and, until recently, he served on the staff of the Adjutant-General at Canadian Army Headquarters, Ottawa, where he held the rank of captain.

• • •

New V-P for Dow Corning

Dow Corning Silicones Limited has announced the election of **D. C. R. Miller** to the office of vice-president. A holder of a degree in mechanical engineering from the University of Toronto, the new vice-president continues as the company's general manager. Miller was formerly with Duplate Canada Ltd. and Fiberglas Canada Ltd.

• • •

Whitford S. Wyman appointed

Linde Air Products Co., Division of Union Carbide Canada Ltd., recently appointed a vice-president and general manager. The man chosen is **Whitford S. Wyman** who has been with the organization for more than twenty-eight years (ever since graduating in mechanical engineering from Cornell). Wyman has held positions with Linde in research, development and plant supervision and several years ago was appointed vice-president, production.

• • •

Twosome at Dominion Engineering

Word of two new engineers making the company's headlines comes from Dominion Engineering Co. Ltd. Men concerned are **G. D. Lewis, B.Eng. and R. W. Stevens** who take on the positions of research engineer—product and market planning and sales manager—industrial division respectively.

Lewis was formerly secretary of Dominion Engineering and, in his new capacity, will co-ordinate the company's expanding research and production facilities to the needs of the pulp and paper industry.

Stevens, a B.Sc. in mining and mechanical engineering from Queens University, joined Dominion Engineering in 1937 and was assistant chief engineer i/c mining machinery and hydraulic presses before his present appointment.

• • •

ASM president speaks in Toronto

Toronto's Royal York Hotel was the scene of a meeting of the Ontario Chapter of the American Society for Metals on October 5. Guest speaker on this "Past Chairmen's Night" was **Dr. Donald S. Clark,** ASM president. Dr. Clark took as his subject "What do dynamic laboratory tests of metals tell us?"

• • •

A Westinghouse marketing manager

Canadian Westinghouse recently announced the appointment of **Mark C. Lowe** to the position of marketing manager of the company's industrial products group. Manager Lowe's career in the electrical industry spans more than 30 years since graduation from Nova Scotia Technical College. He joined Westinghouse last year from the post of president of Canadian Allis-Chalmers.

• • •

Engineering faculty of U. of T.

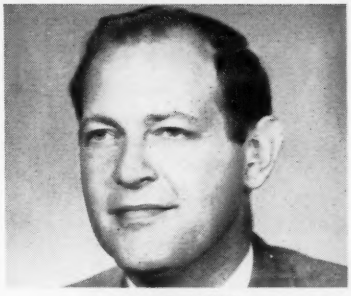
University of Toronto's Sidney Smith recently announced some staff changes in the engineering faculty.

Professor E. A. Allcut, P.Eng., who retired as head of the Department of Mechanical Engineering, has been appointed professor emeritus. **J. E. Reid, P.Eng.,** and **Dr. George Sinclair, P.Eng.,** both of the Department of Electrical engineering, are promoted to the rank of professor.

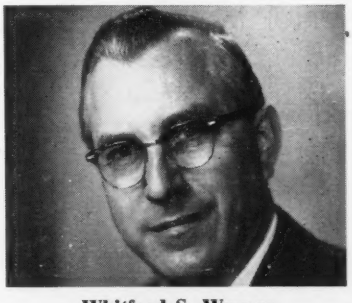
New associate professors are **Dr. I. I. Glass, P.Eng.** (Aerophysics), and **Dr. A. I. Johnson, P.Eng.** (Chemical Engineering). **Dr. G. K. Korbacher, P.Eng.,** becomes assistant professor (Aerophysics).

Dr. G. B. Craig, P.Eng., and **Dr. M. M. Davis, P.Eng.,** join the departments of metallurgical and civil engineering respectively as assistant professors.

Blakely H. Goodings

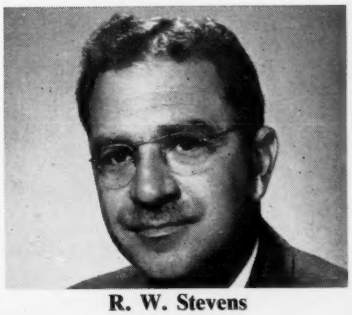


D. C. R. Miller



Whitford S. Wyman

G. D. Lewis



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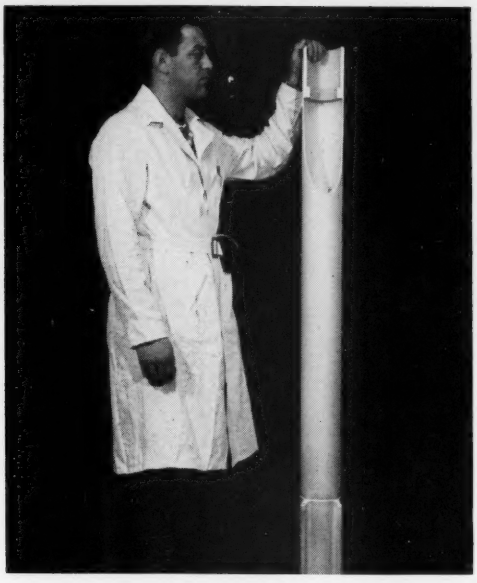


Design Engineering

When to use cold extrusions of aluminum

Complex shapes in strong alloys can be extruded without impact

Fig. 1. A one-piece motor tube having a 5-in. O.D.

What is a cold extrusion?

Almost any definition of an aluminum cold extrusion would invite exceptions. Two criteria are, however, always present:

(1) the starting slug is cold worked in the process, and

(2) some part of the slug is extruded through a die orifice.

The German term "Kaltspritzen," literally meaning "cold-squirting" has some merit as a descriptive term and includes these two required factors without defining the impulse causing the squirting. Until recently all cold extrusions were "impact" extrusions, typified by the toothpaste tube, condenser can and similar thin walled non-ferrous shapes. They were produced only on high speed mechanical presses and "impact" was unavoidable and contributed much to the tradition that impact was essential. Modern cold extrusion technique may use high tonnage, relatively slow speed, hydraulic presses for many shapes, and "impact" is practically nil. (Fig. 1) From a purely technological viewpoint, practically all shapes produced by "impact" could be as readily cold extruded without impact. On the other hand, many complex shapes of strong alloys can be cold extruded, but not "impact" extruded.

By R. A. Quadt HUNTER DOUGLAS ALUMINUM CORP.

Many professional designers would be able to solve their design problems more economically if they were to evaluate the possibility of using an aluminum cold extrusion. Such an evaluation requires a familiarity with this manufacturing technique that is often beyond the experience of many competent engineers. Part of the problem stems from the relatively recent developments that have greatly extended the field, and part of the difficulty lies with terminology.

When to design toward a cold extrusion

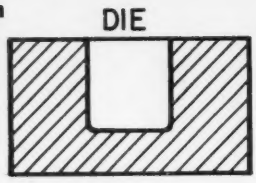
A number of factors concerning a particular part requirement determines how it is to be manufactured in production. Wherever the desirable qualities of aluminum can be employed, the presence of certain requirements of the shape under study should lead the designer to consider a cold extrusion.

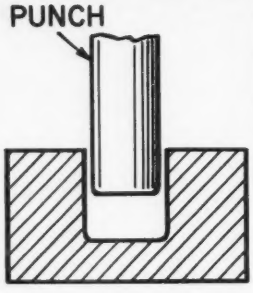
(1) When the part is hollow with one end closed or partly closed: Cylindrical shapes may be round, rectangular, polygonal or even conical in some instances. Symmetry is desired but not mandatory. Especially when the part is longer than 2 or 3 times the diameter is cold extrusion a candidate. The presence of internal or external ribs favors the process and special cavities on the inside or outside of the closed end are readily accommodated. Screw machine production methods become noncompetitive when these latter requirements exist.

Deep drawing processes become non-competitive when the length is much greater than twice the diameter, especially when the thickness of the bottom must be greater than the side walls. On the other hand, it is not generally feasible to produce

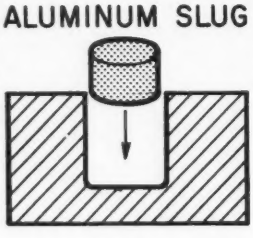
Backward extrusion

Die is of closed bottom construction, of a carefully determined bore size which controls the outside diameter of the finished piece.

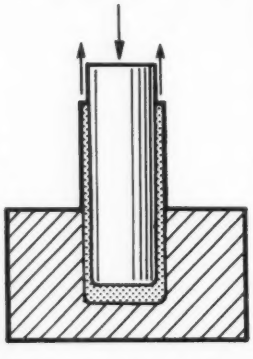




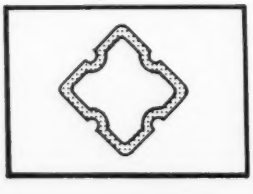
The punch is of somewhat smaller diameter than the die cavity, clearance between punch and die equaling the desired wall thickness of the part to be produced. The metal from which the part is forged is a solid slug, in this case blanked from a heavy plate, rolled to gauge to ensure correct volume, and of a size suitable to fit within the die cavity.

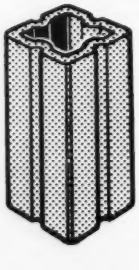


To form the part, the die cavity is loaded with the slug, the press is actuated and the punch strikes the slug a heavy blow. Since the slug is enclosed and the force of the blow is sufficient to cause the metal to cold flow, it has no alternative other than to rise vertically around the punch. Action is instantaneous. The part is subsequently stripped from the punch.



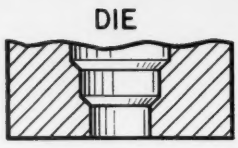
By altering the general contours of the punch and die or details on the punch or within the die cavity, interior features of the part can be made to conform to specific design requirements.



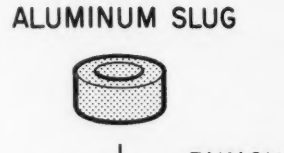


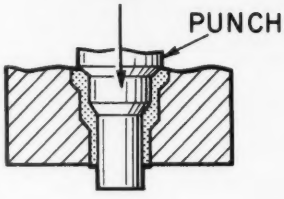
Forward extrusion

Die of of open construction, a portion of the opening serving as an orifice through which the material is extruded.

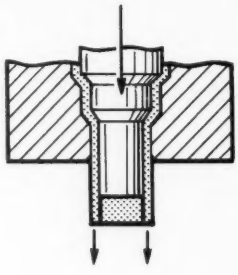


The slug is pierced to accommodate the round projection on the end of the punch.





The slug is extruded forward by compression and the finished part is ejected backward after the punch is retracted. Parts having multiple diameters are ideally suited to the forward impact (Hooker) forging process.



The design engineer should know these terms:

Backward extrusion: Parts that are extruded from a closed bottom die in which the metal flows in a direction opposite to the punch stroke. These are frequently in the shape of cans or shells having a forged bottom and extruded sidewalls. Variations in tool design permit forging solid stems, bosses or other parts within the part. Lengths are generally limited to 10 in. or 12 in. and the length to diameter ratio is normally not greater than 8:1.

Forward extrusion: Parts that are extruded from an open die in which the metal flows in the same direction as the punch stroke. The forward end of the tube may be open or closed and the end may be any reasonable thickness—from 0.020 in. to several inches. Diameters up to 6 in. have been commercially produced, and up to 12 in. contemplated. No mandatory limit exists for the length to diameter ratio and lengths of 100 in. or more have in fact been accomplished. Wall thickness can vary from 0.015 in. to ¼ in. and the open end of the tube may be flanged if desired.

Simultaneous forward and backward extrusion: Parts that are extruded in two directions at once in a single cycle of the press. Somewhat less freedom of design is permitted with regard to the relationship between diameter, walls, webs, ribs and so forth, but where an applicable shape is found the economic benefits can be substantial.

cold extruded cans in which the thickness of the base is appreciably less than the side walls.

(2) When the walls of zero draft are required: On many long, tubular shapes a die casting would be adequate and often competitive except that long tapered cores necessitate draft on the walls that must be later removed by machining if uniform diameter is mandatory.

3) When a pressure-tight container is required: Shapes that must handle liquids and gases without leaking are available as cold extrusions. The completely forged structure is free of porosity and fine grained flow lines insure a leak-proof cavity. There have been many instances where lower cost pressure die castings have given way to cold extrusions because of the inherent lack of structural soundness under the chill cast skin. Even the simplest machining operations, such as tapping cored holes, reveal subsurface porosity that invariably leads to leakers in the castings. This situation does not exist in cold extrusions and any required machining operations are more readily performed because of the superior machinability of the forged structure and the alloys used.

(4) When strength and toughness are required: Cold extruded products attain all the desirable properties inherent in a forged structure. When standard heat treatments are used on suitable compositions, properties are equivalent or superior to aircraft quality hot forgings. The physical requirements of the hot forging, Federal Specification QQ-A-367c are easily exceeded. For many applications heat treatment is not required since the strengths and toughness are excellent in the as-extruded temper. Here again a vast superiority over die castings is noted. Commercial aluminum die castings have yield strengths (0.2% offset) approximating 22,000 psi., while a comparable as-extruded alloy will typically reach 35,000 psi. with guaranteed minimums of 30,000 to 32,000 psi. Yield strengths can seldom, if ever, be guaranteed in a pressure die casting because of the varying porosity from casting to casting.

An airframe application

One well-known application of high strength no-draft forgings is the attachment fitting widely used in air frame manufacture. Draft is not permitted on the vertical surfaces because of the weight penalty. A standard hot forging with even minimum draft would require machining expense to eliminate this extra weight. On many such fittings the loss of fatigue strength at the corners resulting from the interruption of the flow lines upon metal removal cannot be tolerated. A "no draft" cold extrusion is the obvious solution. Produced in 14S-T6, 75S-T6 and Hunter Douglas ZG73-T6, minimum yield strengths up to 72,000 psi. are available.

Contrary to expectation, the cost of these high strength heat treated alloys is no greater than the cost of the lower strength heat treated alloys such as 51S-T6 and 61S-T6. Recent developments have eliminated the traditional extrusion difficulties associated with the high strength, metallurgically complex alloys. It should not be assumed, however, that any heat treated cold extrusion would cost the same as in the as-extruded temper.

(5) When assemblies can be replaced by a one piece design: One of the first family of assemblies to be rapid-

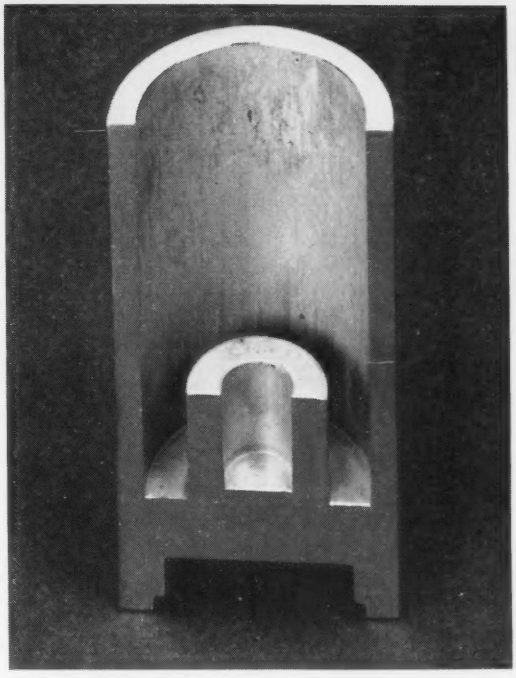


Fig. 2. A backward extrusion of a rocket component with concentric cavities and 1½ in. outer diameter.

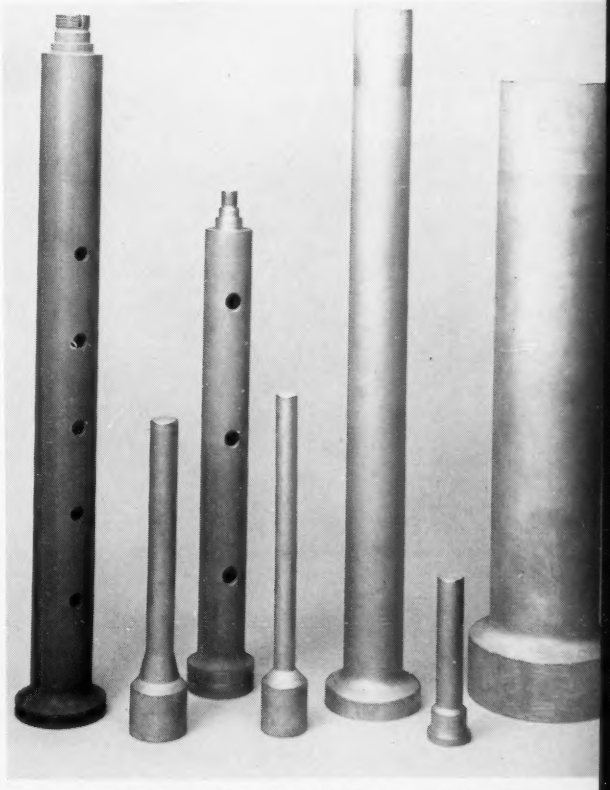
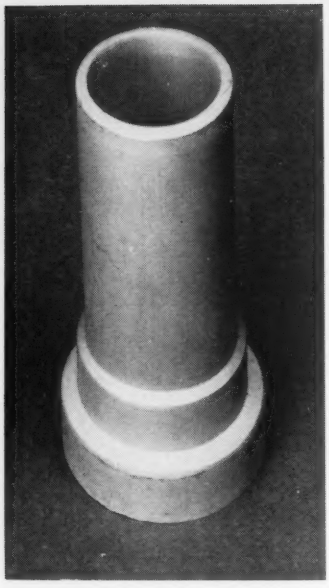


Fig. 3. Forward extrusions of shell burster casings and landing gear plungers. Part at right has 5-in. OD.



Figs. 4 and 5. At left is the machining blank for a fuze body in 14S-T6. It is shown right in machined form.

In some cases aluminum cold extrusions can replace machined cast iron

Cold extruding aluminum continued

ly replaced by cold extrusions is the can formerly fabricated from a welded tube with a welded or assembled bottom. These are now available in one piece seamless construction (fig. 3).

A good example is also apparent in figs. 6 and 7. The part was an Ordnance design originally constructed from three pieces, two of aluminum and one of steel. The cold extrusion was finally developed as a single forward-backward extrusion of HD11-T6 alloy at an appreciable saving in cost, and a greater degree of reliability was achieved since a percentage of the assembled design had an alarming tendency to come apart when subjected to operating pressures applied in the long tube.

Another example is an assembly of two aluminum cold extrusions that replaced an original four-piece construction. The outside can is made as a backward extrusion, and the inside guide tube is produced as a forward extrusion. The bottom of the can, containing two drive slots, and the flange on the inner tube, replaced the two end plugs formerly required to complete the initial assembly. By pursuing this mode of attack the designer can often achieve lower cost, greater strength, improved appearance, reduced weight and greater rigidity.

In fig. 1 is shown a cold extrusion of a motor tube for a 5-in. diameter rocket. The original design specified a straight 5-in. diameter hot extruded tube the full length of the motor. Over the rear two foot length a separately extruded ring containing the ribs was cemented. The front end required the attachment with bolts of a separate internal cup. As shown in the photograph, all three pieces were incorporated as a one-piece cold extrusion. The advantages were lower over-all cost, greater strength, elimination of serious assembly problems, reduced weight, increased reliability and elimination of complex inspection procedures.

This motor tube is an excellent example of the present state of the science of aluminum cold extrusion. Three years ago this shape and size in a strong alloy would have been considered impossible. The technology has grown to the point where this shape has reached production status in an alloy guaranteeing 70,000 psi. minimum yield strength and 7% minimum elongation. The tube is straight within 0.020 in. over the entire length and wall thickness in any ring section is uniform to ±0.001 in.

(6) When design can eliminate machining operations: Cold extrusions can be produced to very close tolerances. Diameters can be held to ± .010 in. readily, and if necessary ± .005 in. is equally feasible at no additional cost in most instances. Walls can be held to screw machine tolerances. On most parts machining can be limited to cutting to length, drilling and tapping.

In some cases where considerable metal must be removed in screw machine operations, substantial economies are possible as a result of elimination of the operation itself as well as the metal savings. In many bar or tubular shapes, the presence of a number of concentric diameters may permit striking cost reduction because of the reduced amount of metal required to produce the shape as a cold extrusion. Figs. 4 and 5 show a fuze sleeve of 14S-T6 that was originally produced from tubing on an automatic screw machine. Over 75% of the weight of the expensive tubing was machined away. As a cold extrusion in production, to tolerances as close as 0.003 in., the cost of the part ready for secondary machining operations was considerably less than the cost of the required weight of tubing necessary for the screw machine.

TABLE I SUITABLE ALLOYS FOR EXTRUSION

Alloy and temper	Minimum tensile strength psi.	Minimum yield strength (0.2% offset psi.)	Minimum elongation on 2 in.
2S (as extruded)	18,000	17,000	3%
HD11-T82*	35,000	30,000	3
61S-T6	38,000	35,000	7
A51S-T6	44,000	37,000	7
HD11-T6*	50,000	42,000	7
14S-T6	65,000	55,000	7
75S-T6	75,000	65,000	7
ZG73-T6*	80,000	72,000	7

*Hunter Douglas Alloys.

(7) When quantities are high: Generally speaking the cold extrusion process finds economic justification when monthly production quantities are high. 1,000 per month in small sizes might represent a questionable item, while 10,000 to a million per month or more would certainly represent desirable production. On the other hand, 1,000 per month of large, inherently expensive items would represent excellent volume.

Experience has shown that specific requirements in volving some inter-relationship of strength, tolerance, machinability and elimination of assembly problems dictate that monthly quantities as low as 30 to 100 quite adequately justify the additional unit cost of manufacture. This situation is often encountered in airframe production, or during the development of shapes that may later reach desired volume when expected sales materialize.

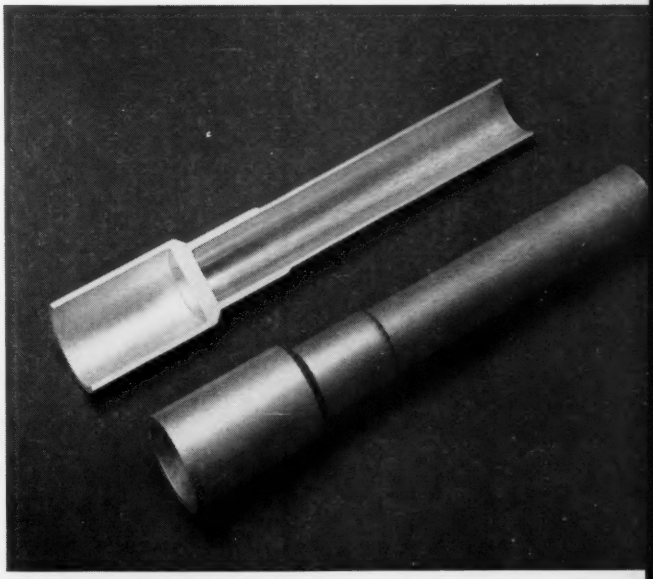
Alloys Available

Generally speaking all the commonly used forging and extrusion alloys are readily cold extruded. Most engineering requirements are met by the alloys listed in Table I. It is obvious that a wide range of strengths is available to the informed design engineer. No longer should he feel limited by the previous status of the process in which cold extrusions were primarily "impact" extrusions in which the great volume of components produced were essentially in 2S or special purity aluminum, with only a small percentage of the overall tonnage being made in the strong heat treated alloys; and generally even these had to be simple shapes of relatively thick walls. On the contrary, it is possible to obtain long tubular shapes with closed bottoms, of the highest strength alloys, in thinner walls than can be produced in the conventional hot extrusion process. Large diameter tubing with 0.040 in. walls and internal ribs in ZG73-T6 alloy, 50 in. and longer, with closed and complex shaped bottoms, is now in regular production.

Finishes Available

Cold extrusions have smooth surfaces measuring between 30 and 100 micro-inches. For most commercial applications no additional finishing operations are required. If desired, the extruded surface can be polished, satin finished, anodized or painted.

If high resistance to corrosion, wear or abrasion is desired, a hard coat of 0.001 in. up to 0.006 in. can be applied electrolytically. It is most readily produced on 75S-T6, HD11-T6 or ZG73-T6 alloys and in some designs the use of this new composite engineering material has been very successful in applications requiring a surface hardness equivalent to hard chrome plate along with the low density and high strength. ★



Figs. 6 and 7. The three pieces of the assembly shown at left were replaced by a forward-backward extrusion.

The application of hydraulic packings

The race for technical superiority has accelerated the natural evolution of new methods, materials and products — among them hydraulic packings

By E. P. Stahl GARLOCK PACKING COMPANY

Fig. 1. Unit type leather and rubber seals.

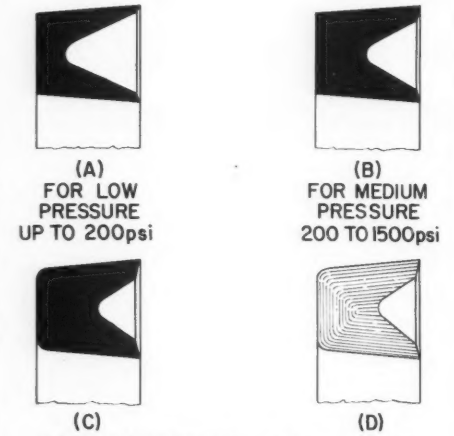


Fig. 2. Varying cross-section with pressure.

There is an adage to the effect that "Necessity is the mother of invention" and when the steady march of peace gave way to the struggle for national existence in World War II, the race for technical superiority accelerated the natural evolution of new methods, new materials and new products. This brought into sharp focus the subject of unit or lip type seals for hydraulic equipment.

Packings for hydraulic equipment can be described as oil seals, primarily designed to withstand fluid pressure. They differ from the unit (or lip) type seals shown in fig. 1, the primary function of which is to retain the lubricant in a bearing and exclude foreign matter therefrom.

Automatic packing of U leather, hat leather and cup leather type, made of oak-tanned and chrome-tanned leather, are most satisfactory for water presses and have been in existance with little change since the hydraulic press was invented in 1795.

Chrome-tanned leathers are sometimes used with oil, but oak-tanned leathers are not suitable for use with mineral oil which tends to dissolve the natural fats in leather and make it brittle, particularly if the oil gets warm.

The ideal sectional shape of a hydraulic packing depends not only on the pressure and other operating conditions but also on the packing material used. Packings made from soft materials behave as a general rule under low pressures as hard or tougher materials behave under higher pressures. The U packing cross sections shown in fig. 2 for various pressures are for general guidance only; they are based on a relatively hard grade

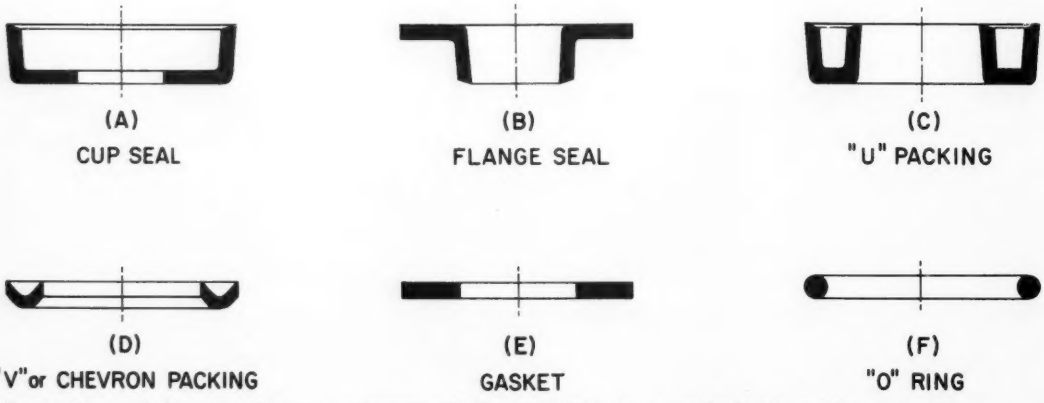


Fig. 3. Some of the many different seal types which are available for use as hydraulic packing components.

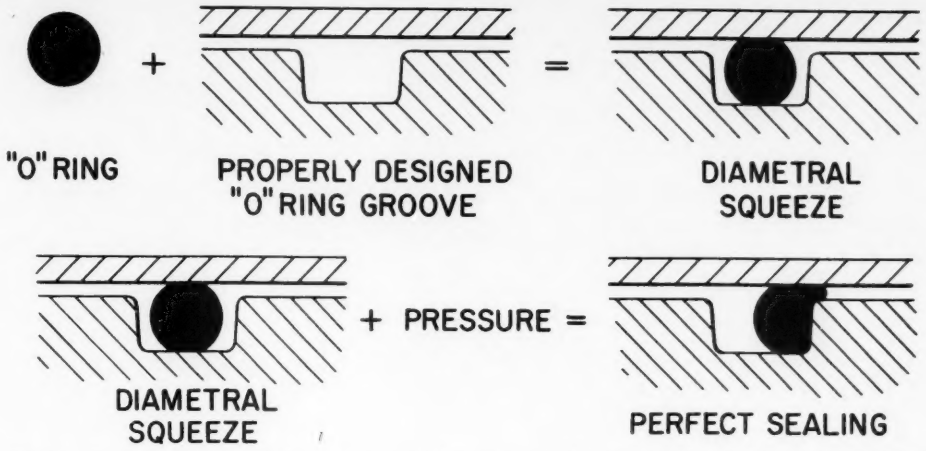


Fig. 4. O rings are usually fitted in rectangular slots machined into the hydraulic mechanism.

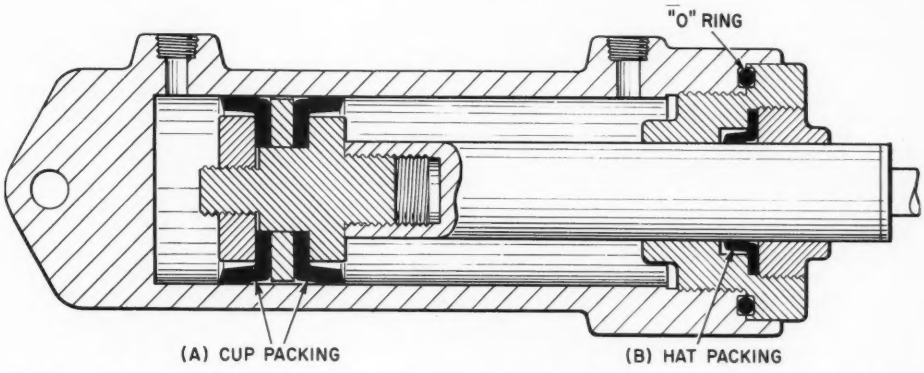


Fig. 5. A hydraulic jack with back-to-back cup packings separated by a strong shoulder support.

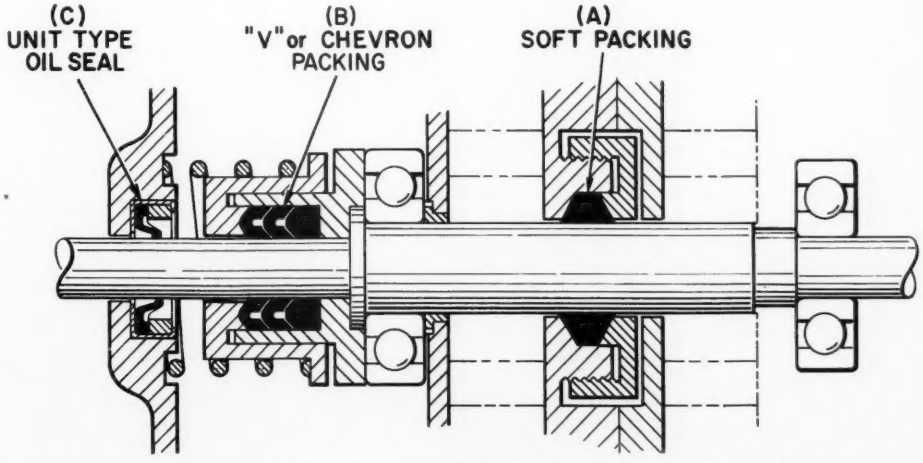


Fig. 6. Some of the many different seal types available for use as hydraulic packing components.

TABLE OF NONMETALLIC HYDRAULIC KINETIC SEAL CHARACTERISTICS

Type Piston Seal	Nonmetallic Seals		
	Cup or U-Packing	Chevron or V-Packing	O-Ring
Type piston rod seal	Flange or U-packing	Chevron or V-packing	O-ring
Adjustable	No	Yes	No
Service life	Very long	Long	Short
Leakage past piston rod seal	Zero with proper expanders	Zero with adjustment	Damp to wet
Leakage past piston seal	Zero	Zero	Zero
Leakage variation in cylinder stroke when temperature and viscosity are constant	Zero	Zero	Zero
Kinetic friction at low pressures	Very low	Medium to high	Medium to high
Static friction or breakaway	Very low	Medium to high	Medium to high
Over-all efficiency at low pressures	Good	Fair to good depending on adjustment	Fair
High pressures	Very good	Fair to good depending on adjustment	Good
Variation of kinetic or static friction at low to medium pressure	Very small	Medium to high	Medium to high
Cylinder bore or piston rod requirements (finish)	Good	Good	Excellent
Straightness and roundness	Fair	Fair	Good
Clearances and tolerances required	Very close	Fairly close	Very close
Maximum operating temperature (deg. F.)	Leather 120-150 Synthetic 120-200	Leather 120-150 Synthetic 120-200	120-200

of synthetic rubber material of 90 durometer Shore hardness.

Cross sections and lip structures of U packings recommended for low, medium and high pressures are shown in fig. 2. (A) is for low pressure, (B) for medium, (C) and (D) for high pressure. Although these designs cover U packings made from synthetic rubber, they are available also in leather, as are hat, cup and V packings. Leather packing is used for extreme flexibility, combined with toughness and good fluid resistance.

It is interesting to note that the higher the pressure, the less important become the sealing lips of U packings.

It is not always realized that in general it is much easier to design a hydraulic packing to withstand medium and high pressures than one to seal very low pressures, that is, atmospheric or light head of oil. Frequently, hydraulic packings are required to withstand appreciable working pressures and be effective also in preventing oil leakage when the mechanism is not in use or not under pressure. The latter conditions necessitate some means (such as a finger spring or garter spring) for preloading the sealing lips when not actuated by fluid pressures. For low pressures, say up to 200 psi, the lips of hydraulic packings should be comparatively long and flexible as shown in fig. 2(A). For medium pressures, say 200 to 1,500 psi, a stouter lip and heavier cross section (fig. 2 (B)) are desirable. For high pressures of 1,500 psi upwards, a stiffening of the section and shortening of the lips (fig. 2(C) and (D)) are desired, Design (D) is a cloth inserted or fabric seal with a heavy cross section.

Fig. 3 shows the various shapes of packing and seal used in hydraulic and pneumatic equipment designed to meet the requirements of piston rods and static joints.

The most common example of hydraulic packing is the cup leather shown in fig. 3 (A) used in bicycle pumps. This seals air in one direction but allows free passage in another.

One of the most interesting, ingenious and simple of automatic packings is the O ring shown in (F). These rings came into prominence for aircraft designs during World War II.

The O ring is a torus of simple cross section, or the solid of revolution produced by rotating a circle about a straight line axis lying in its plane but not intersected by the circle. More specifically the shape is that of an annulus or doughnut. The O ring is round in cross section and a perfectly circular, synthetic rubber ring, molded and trimmed to extremely close tolerances on the ID and OD. It is generally fitted into a rectangular groove machined in the hydraulic mechanism as shown graphically in fig. 4. O rings, though deformable, are incompressible in volume.

Limited only by ingenuity

The application of O rings to hydraulic and pneumatic sealing problems is limited only by the ingenuity of the design engineer. Millions of dependable installations have been made for industrial and aircraft uses. Their simple construction permits them to be fitted into a limited space, without close fittings and space consuming supporting structures.

For many years packing manufacturers have used rubber in various forms and shapes as sealing devices. Prior to the development of synthetic rubber, such packings had limited applications. The many oil and chemical resistant elastomers now available open up an almost unlimited field for new packing materials of various kinds and shapes.

The term synthetic rubber covers a material having widely varying properties such as hardness, resilience, cold flow, ageing and so forth. These properties vary with temperature, pressure and the nature of the liquid being sealed.

Pre-ageing of synthetic rubber packings in hydraulic fluids gives much more consistent results than packings that are not aged or those that have been subjected to a variable amount of air ageing. It is suggested that packings be soaked in hydraulic oil, wrapped in cellophane, pliofilm or aluminum foil and packaged in a suitable container, the latter to be stamped with the appropriate identification and date of manufacture.

For the convenience of design and product engineers, the characteristics of non-metallic kinetic hydraulic seals are shown in the table. Hydraulic packings or seals are automatic in action in that they make use of pressure to promote sealing.

When the term fluid is used in discussing hydraulic packings or seals it is used in its widest sense to include both liquids and gases and consequently remarks regarding the design of packings for hydraulic systems also apply generally to pneumatic applications. Pneumatic packings, though not interchangeable with packings for hydraulic equipment, are somewhat similar. Usually the softer grades of packing are more suitable for pneumatic systems, where pressures are usually low, flexibility and rapid reaction of packings to changes in the pressure being advantageous. The same remarks apply to sealing gases other than air, although here it is important to consult the packing manufacturer regarding the choice of suitable material to resist the particular gas in use.

It seems desirable and expedient at this point to illustrate and describe some equipment in which hydraulic packings are used.

Hydraulic Jack

Fig. 5 shows a cross section of a hydraulic jack using synthetic rubber fabric or cloth-inserted cup packings on the piston mounted back-to-back, separated by a strong supporting shoulder. A synthetic rubber fabric or cloth-inserted cup or hat packing is used to seal the piston rod where it passes through the end of the jack. The application of these hydraulic packings is fairly representative of applications of this kind. At high pressure it is increasingly important to reduce piston clearance to an absolute minimum in view of the danger of heel extrusion.

Aircraft Pump

Fig. 6 shows hydraulic packings applied to an aircraft pump. (A) shows a conventional packing gland fitted with soft packing. (B) shows a spring-loaded chevron packing used as a shaft seal on the pump. chevron packings for aircraft pumps were originally made from fabric impregnated with synthetic rubber but these were insufficiently pliable and were subsequently replaced by a chevron packing of synthetic rubber. (C) shows a unit (or lip) type seal shown earlier in fig. 1, used to retain lubricant in the assembly and exclude extraneous matter. This type of seal is necessary for pump to function properly.

It should be noted that with the chevron type gland packings, a ram tends to unwedge the packing on the pumping stroke, whereas a press ram tends to wedge the packing on the working stroke. The conditions are reversed for piston packing. Thus with a piston packing of a hydraulic press, the friction of the packing within the cylinder bore resists extrusion on the working stroke, and in a piston packing of a pump the friction between the packing and the cylinder bore assists extrusion on the delivery stroke.

At this point it seems desirable and expedient to say something about the installation or fitting of hydraulic packing to various pieces of equipment. As with the unit (or lip) type oil seals of fig. 1, care must be taken in installing hydraulic packings because most of them have interference at the sealing lips. Consequently, the outer sealing lip is invariably larger than the bore, the cylinder into which it fits and the shaft packing is invariably smaller than the rod or shaft on which it fits. Very often packings have to be pushed past screw threads or over splined shafts. To circumvent these assembly conditions it is often necessary to use assembly sleeves or spigots. Where it is impossible to use these assembly tools (and such cases are perhaps rare), a lead chamfer (fig. 7) covering a U packing assembly for a hydraulic jack should be used.

Care must be taken

It is often necessary also to push the packing over the shaft or through a cylinder in which there are holes or ports. In such cases, not only must burrs be removed but when possible assembly spigots or sleeves should be used. Fig. 8 shows the method of assembling a hat packing over the end of a shaft of a hydraulic jack using a spigot.

Causes of Failure

It seems appropriate at this point to enumerate some of the common causes of the failure of hydraulic packings and their remedies.

Leakage is the ultimate result of any hydraulic failure. The causes are numerous and include abrasive

wear, roughness, or poor finish of metal parts, poor installation, inadequate compression of flanges, use of wrong material to withstand pressures encountered, temperatures too high for packing material used, heel extrusion, unsuitable packing design, binding, hardening, softening and swelling.

(1) **Abrasive Wear**

This condition is due to the roughness or poor finish of metal parts; the presence of scores and grit or abrasive matter or blow holes in the cylinders. Whenever possible, parts on which packings operate should be hardened, ground and polished. Chrome plating also helps in some cases. Grit should be removed from the fluid by filtration.

(2) **Heel Extrusion**

Caused by forcing packing material between the piston and cylinder (or piston rod and gland housing) followed by the tearing of trapped packing material due to excessive piston clearance or unsuitable material.

The remedy: reduce the piston clearance if the design permits. If this does not result in a complete cure, con-

(Continued on page 74)

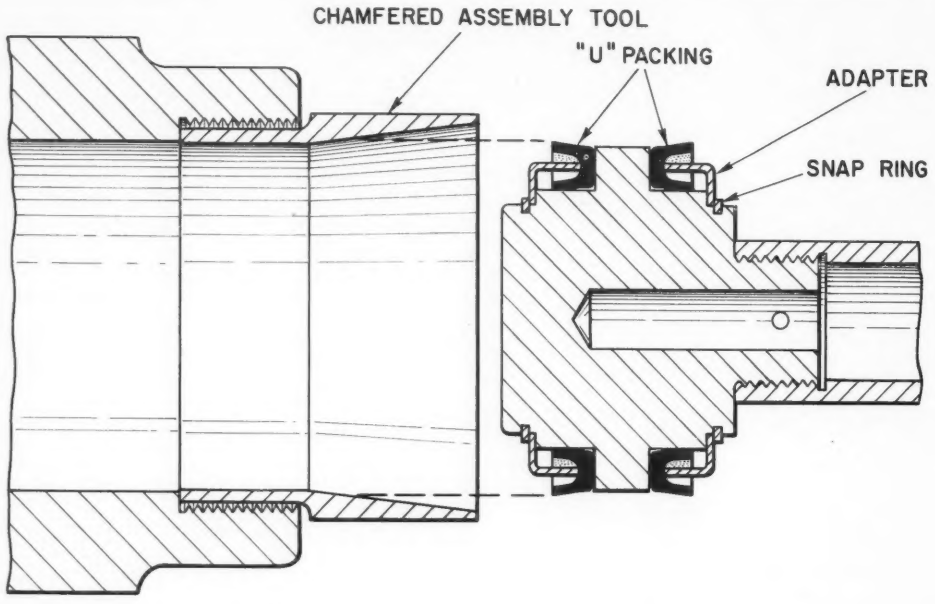


Fig. 7. The installation of a "U" packing for the piston of a hydraulic ram.

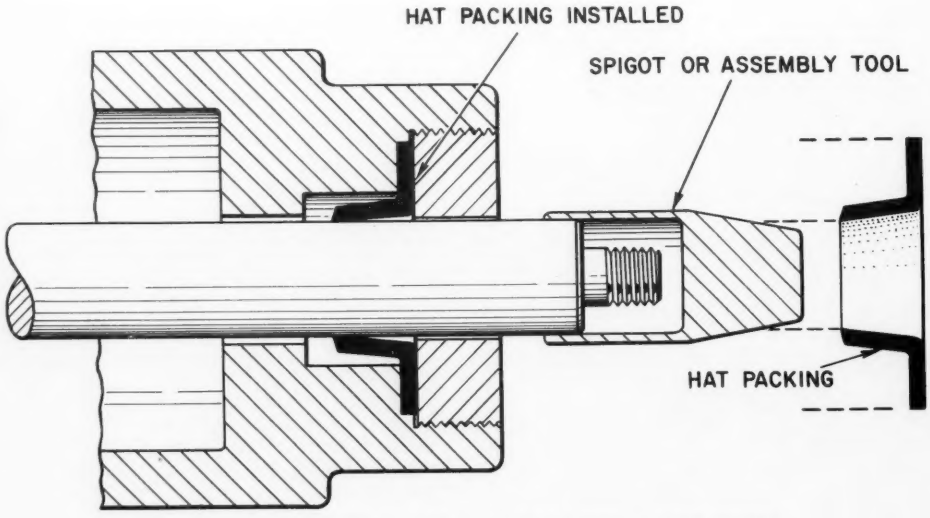


Fig. 8. The installation of a hat packing for a hydraulic ram spindle.

A report on the Canadian IRE Show

With the first convention of the Canadian IRE now in the past it can go down in the records as a complete success. Plans are already under way for a repeat show.

By Ian Dutton P.ENG.

J. A. WILSON LIGHTING AND DISPLAY LTD.

The first Convention and exposition of the Canadian IRE was a bold venture, skilfully planned and successfully executed. The aim of the convention was to further the development of Canada's electronic and nucleonic industries. It is to be hoped their success in 1956 will persuade them to make this an annual event.

My first call was at the booth of Varian Associates of Canada Ltd., where Jim Court confirmed that the company was rapidly adapting itself to life in Canada. The trained personnel brought in from the States last year to set up operations in Georgetown, Ontario, are being replaced by Canadians as quickly as they acquire the necessary skill. By the same token, the products are being manufactured in Canada in ever increasing numbers.

The newest item on display was the Varian G-11 Strip Chart Recorder, scheduled for early production in Georgetown. This is a versatile recorder with a unique span-adjust, high source resistance and a number of optional features, such as a continuous reference system in lieu of the standard mercury reference cell. The G-10 Graphic Recorder was also on display. This is now in production and sells at the same price in Canada as in the United States. A number of klystrons were shown, several of which are being produced here.

A fascinating display caught my attention at the Eitel-McCullogh Inc. booth. Two of their new ceramic receiving tubes were being subjected to cruel punishment while in operation. One tube was having the thermal shock treatment with alternate baths in liquids of —75 deg F and +400 deg F, while the other tube was repeatedly subjected to a mechanical shock equivalent of 40g.

Electrically, ceramic tubes are comparable to standard receiving tubes, but mechanically there is no similarity. The tubes are constructed of saucer shaped elements stacked on top of one another and separated by ceramic rings to form a neat cylindrical package about an inch high and an inch in diameter. With the electrode assemblies self-supported in this manner, the tubes can withstand great mechanical and thermal shock while producing low noise output. Continuous operation is also possible with envelope temperatures in excess of 300 deg C.

Eimac is now producing four of these tubes: a twin-triode amplifier, a sharp cut-off pentode, a medium-

Forces interest came from Flying Officers Guindon and MacGier as J. Pray of Westinghouse explained Nultrax.

Visitors from the University of Copenhagen, C. Topsoe-Jensen, lending an ear to Ferranti's Wood and Davis.

mu triode and a beam power amplifier. The two last mentioned are developmental tubes. The twin-triode and the pentode will soon be available in Canada at prices comparable to the equivalent ruggedized tubes now on the market.

Also displayed by Eimac were two experimental ceramic tubes: one a tetrode and the other a triode for use in low band mobile transmitters. Both are rated at 1 kw and should be on the market in a few months time. For use in forward scatter communication they have developed a 10 kw klystron, tunable over the entire band of 1700 to 2400 megacycles. It requires less than one watt driving power and has a rated overall efficiency of 46%.

It was a pleasant surprise to find that E. G. Lomas has formed his own company representing a number of American manufacturers. Included in the display were some new products of Microwave Associates Inc., such as types 1N21E and 1N23E silicon microwave mixer diodes. Both feature very low noise level. Also displayed was the sub-miniature hardware produced by Circon for use with printed circuits and lightweight equipment. Without my bifocals, it was difficult to see all the fine workmanship on this line of subminiature neon lamps, instrument eyelets and multiterminal connectors.

Across the aisle at the Canadian Electric Resistors Ltd. booth, Mr. Beeby took time out to give me some of the history of his company and their products. They have facilities in Toronto for maufacturing a range of vitreous enamelled, power type resistors. In addition, they market Berco wire wound potentiometers, industrial type rheostats, sliding resistances and grid resistors. A recent introduction has been the group of Rotary Regavolt auto transformers. These are light, compact controls variable from zero to about 20% above the supply voltage.

Mr. K. R. Keith of The Sphere Company, Inc., was busy explaining compression seal terminals as I approached the booth, so I listened to the conversation. These have been designed to meet the new MIL-T-27A specifications for Twist-Free terminals. Sealing is accomplished with a tough silicone rubber under compression for mechanical strength, insulation resistance and good dielectric strength, even at higher temperatures. The application is in capacitors, transformers, chokes or other components requiring high voltage terminals.

A. C. Nelson of C.G.E. examines a Bendix computer with Mr. H. M. Wilkinson (r) of Computing Devices of Canada.

The equipment displayed by Ferranti Electric Limited attracted a large number of interested spectators. The "Janet" equipment recently declassified by the Department of National Defence, was one focal point. This project is a new long range communications technique developed by a Defense Research Board team following the lead of Dr. P. A. Forsyth. The principle is to use the ionized trail of small meteors to reflect radio waves and make reliable high-frequency communication possible at distances up to 1,000 miles. Hundreds of small meteors enter the earth's atmosphere every hour; for communication reflection each has a useful life of about one second. The equipment must detect a suitably located meteor trail, then transmit the previously stored message rapidly during its useful life. Storage units in both the transmitter and receiver permit the information to be injected and extracted from the equipment at standard teletype speeds during the intervals between transmission bursts. Ferranti Electric engineers are engaged in further development of the transmission equipment.

A Post Office application

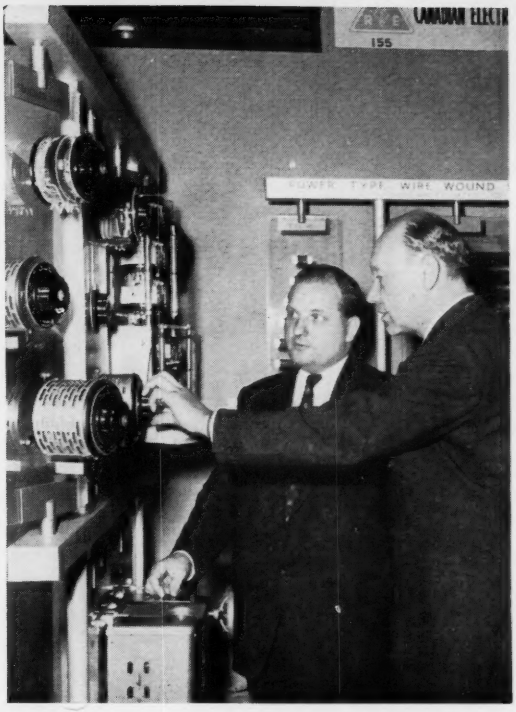
The other focal point of interest at the Ferranti booth was the Route Reference Computer used in the Canadian Post Office Electronic Mail Sorter. This is a special purpose transistor computer utilizing fifteen standardized types of packaged circuits. Each circuit consists of a card with printed wiring and sub-miniature components on both sides. The card fits into an eighteen pin socket. Computers for other applications could be built economically by selection of the proper cards from stock. The magnetic drum used for data storage employs the air-bearing principle to minimize maintenance and facilitate changing drums.

At the Fischer and Porter Canada Ltd. booth, Jim Bell explained their Digi-Coder, which is used in most of their data reduction and automation systems. This is a shaft-position, analog-to-digital converter which accurately converts shaft position into discrete electrical contract combinations by purely mechanical means. This type of equipment is used to translate temperature, pressure, weight, speed, flow, level, strain and similar information to electric typewriter, summary punch, tape punch, computer or magnetic tape records.

Electronics is assuming a more important role in industry. At the Canadian Westinghouse Co. Ltd. booth, J. Pray demonstrated "Nultrax," a transducer unit for high-precision measurement of linear displacements. This is a helical differential transformer capable of converting dimensional data to precise electrical equivalents with a high degree of accuracy. Used in conjunction with either mechanical controls or servos, it provides a means of controlling machine tools, instruments and assembly operations, either locally or from a remote site.

Mr. C. Mills, the engineer in charge of the Westinghouse Environmental and Appraisal lab, used the model on display at the booth to give me a detailed account of the facilities. It is very encouraging to learn

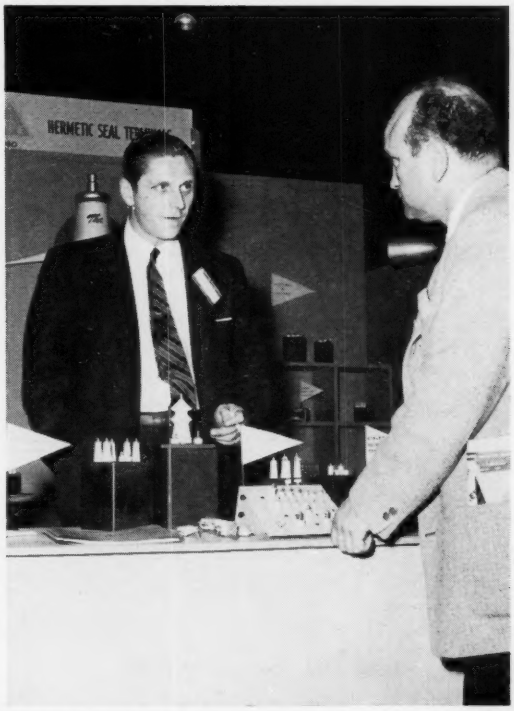
The new White Noise Generator is demonstrated by S. A. Rybb of Dawe Instruments. R. White is the onlooker.



Nagy of Computing Devices got some information on a Canadian Electric Resistors product from K. J. Beeby.

The exposition showed 'Canada made' to be as good as the world's best

Student John Fisher from Ryerson discusses ceramic receiving tubes with O. H. Brown of Eitel McCullough.



At the Sphere Co. booth K. R. Keith talked compression seal terminals with Paisley of Paisley Products.

D. Mallard of PSC Applied Research Ltd. shows off the R Theta Navigation Computer System to Mr. R. Chaffey.

Canadian IRE Show continued

that extensive facilities such as these are being established in Canada to promote design and development.

While on the subject of design and development, the Velvet Glove project was evident at several booths. The Velvet Glove is of course a missile designed to be fired from aircraft. The primary function of the project, however, was to assemble a team of men in Canada with experience in the art of designing, building and using guided missiles. The missile was displayed at the Westinghouse booth along with samples of the electronic equipment. As would be expected, printed circuits and subminiature, ruggedized components have been used. Most of the sub-assemblies were also encapsulated to permit close spacing of components and prevent failure at high altitude and under great mechanical strain.

Over at the Computing Devices of Canada Limited booth I found another element of this project: photographic equipment used to record the missile in flight. This Universal Instrumentation Package, fitted out by CDC for the RCAF, consisted of a wing tip tank from a CF 100 carrying two high-speed movie cameras, a recorder, radio receiver and instruments for accurate measurement of the aircraft's altitude, airspeed and course. When fitted to the wing tip of a CF100 it can be used to record details of airborne trials of aircraft and armament.

The position of many Canadian electronic firms was quite evident at the CDC booth. Some of their best products, the digital and analog computers, designed and built at their plant in Ottawa, could not be displayed or discussed because of security restrictions. However, CDC is now marketing a low-cost, general purpose digital computer, the Bendix G-15. This was on display at the exposition.

An instrument that has been in the news during the past year is the R Theta D-R Navigation Computer System. This electromechanical computer was invented by Wing Commander J. G. Wright, RCAF and earned him the McKee Trans-Canada Trophy for 1954. At the PSC Applied Research Limited booth, Mr. D. J. Dalzell demonstrated the complete system. This has recently been redesigned to use transistors instead of tubes.

The instrument is essentially a very accurate plotter that gives continuous indication of the plane's position relative to its base or starting point. The pilot can also "home" on any other point, provided he knows the distance and bearing of the selected point relative to his base. This information could be inserted while in flight. During operation the computer is fed true airspeed and compass bearing information.

One of the important mechanical elements of the computer, the Ball Resolver, was on display at the Aviation Electric Limited booth. The resolver is fed length (or rate) and angular information and resolves it into two mutually perpendicular components for plotting the position of the aircraft by the co-ordinates. The instrument is in production at the A.E.L. plant in Montreal and features high accuracy, long life, vibration resistance and light weight.

A number of other items were on display in the PSC booth that will be of particular interest during the International Geophysical Year.

The company's T232 Mark 7 instrumentation camera has been adapted for sky observations by being mounted over a curved mirror to photograph reflections of the sky right to the horizon. Designed primarily for use in the study of the aurora borealis, the camera will provide a continuous record of sky conditions for later study and reference.

Another instrument to be used for this study is the Auroral Recorder Type T609, developed by Dr. D. Hunter, University of Saskatchewan. The instrument is designed to produce a photo-electric recording of auroral phenomena. The tabulated results are obtained directly in the form of a punched tape and indicate the brightness of the auroral display (corrected for cloud or haze conditions), the position in the sky and the time of measurement.

Two major units, a scanning head and an amplifier, make up the recorder. The scanning head contains an optical system for step scanning, a sensitive photomultiplier tube and a selective filter to detect auroral radiation at 5577 Angstroms and convert it to electrical impulses for measurement and recording.

Canadian test instruments

Dawe Instruments Limited, Canadian Division, has been marketing a number of very fine test instruments in Canada during the past few years. Two new ones have just been added to the list — the White Noise Generator, Type 419 and the Strobominor, Type 1210. The generator provides electrical noise uniform in level over wide frequency bands. Three handwidth ranges are provided, covering 30 cps to 20 kc, 30 cps to 500 ks and 30 cps to 5 mc, having an output level within ±2db ± 3db and ± 8db respectively. Suggested uses are for testing room acoustics, loudspeakers, microphones, audio amplifiers, receiver interference and cross-talk in multi-channel carrier telephone systems.

The Strobominor is a small, low-cost stroboscope for studying the cyclic-operation of mechanisms in slow motion and for measuring speed. The single scale is calibrated directly in rpm with a range from 600 to 7,200 rpm. By using multiples of the flashing speed, the range can be extended to a practical upper limit of 50,000 rpm.

An electron microscope on display at the Rogers Majestic Electronics Limited booth brought back mem-

D. R. Taylor (l) hears W. R. Ratcliffe explain features of the Ball Resolver made by Aviation Electric Ltd.

Gilfert of North American Aviation stopped to talk to Collier of C.G.E. on airborne radar and mobile radio.

"It was a bold venture, skilfully planned and successfully executed."

Printed circuits by the Xerographic process is being explained by Haloid's E. B. Morgan to Mr. D. Beechey.

Lowdown on the Sinclair Pyrometer is delivered by Dr. W. V. Tilston to Kathy Hunt from the George Kelk booth.

ories of a great Canadian scientist. The late Dr. E. F. Burton provided the leadership that resulted in the construction of the world's first successful electron microscope at the University of Toronto in 1937. It's a long step from the original hand-made laboratory model to the neat, compact production models of today. The operating techniques have shown an equally remarkable advance by all accounts.

The Type EM-75 electron microscope on display is a medium powered instrument suitable for use in many types of research and production control or as a companion instrument to make preliminary investigations of specimens being prepared for the higher powered Type EM-100B.

Some specialized instruments

The Scientific Apparatus Division of Rogers Majestic is now selling a number of specialized instruments, together with the engineering service to assess customer requirements, install and service the equipment and train the customer's personnel. Analytical and industrial X-ray apparatus, nuclear radiation equipment, diffraction equipment, high voltage impulse testing equipment, utlra-sonic generators and a liquid air machine (with an output of five quarts per hour) are available.

Transistors have not yet succeeded in completely eliminating tubes, but they are appearing in more and more equipment, such as the Motorola Radio Pager on display at this booth.

Sinclair Radio Laboratories Limited have already established an enviable reputation as designers and builders of high quality antennae for communication, radio telephones, radar, radio and television broadcasting and other special applications. They have now extended their range of products to include a radiation pyrometer and a chart analyzer. The pyrometer, originally developed at the Strachan Avenue Labs of Hydro Electric Power Commission of Ontario, can measure temperature rise (5 deg C minimum) with a field of view 0.07 deg by 0.88 deg. The original purpose of the instrument was to check the temperature rise of splices in transmission lines, as a means of detecting faulty splices with the lines in operation and the operator located on the ground or in the back of a truck.

The chart analyzer will scan 18 levels on a strip chart and record the number of times the curve traverses each level over the entire length of the chart or any chosen segment. It was designed to scan antenna propagation charts (a task previously done laboriously by hand) but can be applied to any strip chart. The original specifications were drawn up by Dr. D. Hay of Defense Research Board, with the final design and construction being carried out by the Sinclair organization.

To meet the standards of customers, and particularly the armed forces, electronic equipment must be capable of operating without failure under severe conditions. To ensure that it will meet these standards, manufacturers subject it to comparable conditions within their test labs. Conrad Inc. displayed a complete line of environmental chambers in which electronic equipment can be operated under conditions of low temperature, high altitude, high temperature, controlled humidity and vibration.

With so much attention directed toward the production of radar, microwave equipment, computers and television transmitters there is danger of overlooking one of the original fields of electronics — AM broadcasting. During the past two years Canadian General Electric Co. Ltd., has devoted a considerable amount of time to the development of AM broadcast transmitters for 250 w, 500 w, 5 kw and 10 kw output. These feature several new components, particularly new output tubes to obtain maximum performance with minimum cabinet space. They have also been designed for remote control operation with control being effected from the studio through the medium of the CGE broadcast remote control unit. Present plans call for these transmitters to be marketed in the United States through the General Electric Company.

The electronics industry in Canada would certainly not be anything like its present size if it were not for

(Continued on page 76)

Rogers Majestic's electron microscope fascinated many including Major A. Smedmor. M. Shelley is explaining.

C. F. Conrad (l) and C. Williams of the Helipot Corp. discuss one of the Conrad Environmental Test Chambers.

Heated metal parts being dipped into a dry bed of fluidized powders which melt to form the plastic coating.

Heat it, dip it and it's plastic-coated

This new plastic-coating process can handle metal, ceramic, glass or wood

There's a new baby in the family of coating processes and the name of the infant is Whirlclad.

This process for coating metals, ceramics, glass or wood with various plastics and other substances has just been announced. Its purpose is to combine the natural advantages of the coating materials with those of the parent materials to be coated.

Reported to require relatively inexpensive apparatus, it consists essentially of dipping preheated articles into a dry fluidized bed of coating material in finely divided solid form. If desired, heavier coatings can be obtained with a single dip than is customary with solvent coating methods. The melting point of the material to be coated must be higher than that of the coating material.

The new process, licensed exclusively by Polymer Processes, Inc., was invented in Germany by the firm Knapsack-Grieshem A. G. of Frankfurt-Main under the name Whirlsintering. The process will be known in Canada under its trademark Whirlclad. A standard licensing program has been set up for selected companies desiring to do their own coating. The necessary equipment to operate the process is also available under this licensing program.

Preliminary experience with this new process has been based largely on coating with nylon and low-pressure polyethylene. Many other materials which melt sufficiently below their degradation temperatures can be used, however.

The process is said to permit use of coating materials which never before have been applied satisfactorily. The polymers used are prepared in finely divided solid form especially prepared for the process. No solvents or dispersing liquids are required.

Earliest applications for the coatings include wear parts such as jigs and fixtures, rollers, bushings, loading hooks, sliding surfaces and corrosion resisting parts such as household appliance racks, plating hooks, valve bodies, fans, ducts and small containers. The company is conducting extensive research to broaden its use with other parts and components.

A nylon coating provides additional wear and scuff resistance, along with low friction where normal lubrication is difficult or impossible. It makes use of nylon's resistance to solvents and alkalies, tends to inhibit rust and corrosion, and provides high voltage or low frequency electrical insulation.

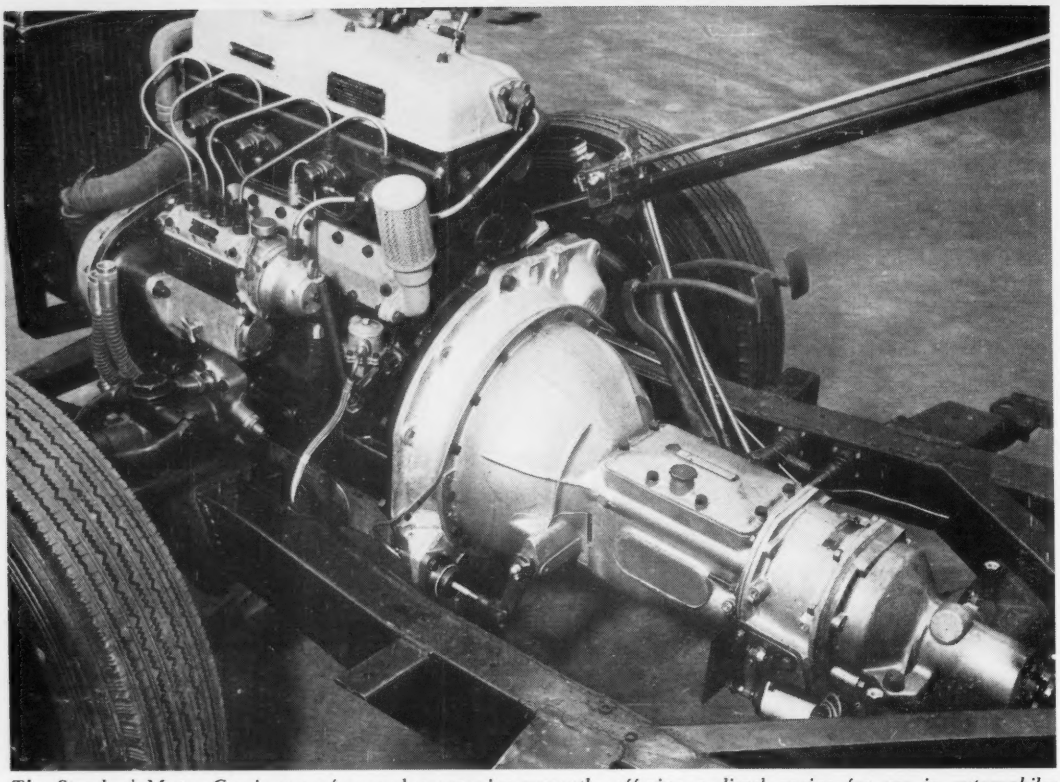
Nylon coatings on metal parts can provide finished articles with strength, rigidity, dimensional stability or tolerances impossible in all-plastic items. They also provide the frictional advantages of nylon on pieces that are too large to make economically or satisfactorily from solid plastic materials by molding or fabricating.

A polyethylene coating adds to the original part such properties as corrosion and chemical resistance, and low and high frequency electrical insulting properties.

Polypenco K-51, a new chlorinated polymer with properties somewhat similar to fluorocarbons, is also reported to lend itself well to the coating process. On metals, Polypenco K-51 coatings offer exceptional chemical resistance combined with zero water absorption. The material's mechanical and wear properties are also considered outstanding.

The Whirlclad process is said to produce evenly distributed, uniform coatings on the base material, even when it is in the form of irregular shaped objects and pipe interiors.

The coating materials are not applied in combination with plasticizers or extenders. Thus there is no chance of such agents affecting the ultimate chemical or mechanical performance of the coated surface. ★



The Standard Motor Co. is one of several companies currently offering a diesel engine for use in automobiles.

What does diesel offer the automobile?

Diesel engines as power plants for the ordinary automobile are only now gaining acceptance in Canada. What advantage can the engine really claim?

By P. E. Biggar

If you live in Toronto or Montreal the chances are that you have ridden in a diesel-engined taxicab. There are now over 60 of these cabs in service. Of course, this is a very small number when compared to the 3,000 or more diesel taxis in service in London, England, but over here this has all been accomplished in barely three months.

The reason for this is simple enough; the diesel engine is the most efficient engine known. In Toronto, for example, the diesel taxis obtain as much as 45 miles per gallon of fuel, compared to perhaps 25 mpg for the same cab fitted with a gasoline engine. In London, the figures are 32 mpg for a large fleet of diesels and 17 mpg for petrol cabs. In city driving, much of the driving time is spent with the engine idling and a diesel engine will idle on less than a pint of fuel an hour.

This is not the only advantage; in Toronto, diesel fuel costs 30c to 34c a gallon, compared to say 40c a gallon for gasoline (both with taxes included). Thus the fuel costs per mile for the diesel car are rather less than half as much as for a similar gasoline-engined car. As a result of this, besides the growing number of diesel taxicabs in use, there are, in Canada, over 250 diesel private cars. This is considerably more than all the diesel private cars in service in Great Britain, where fuel costs (56c a gallon for diesel fuel, 64c a gallon for petrol) are even higher than ours. As far as can be ascertained, all the diesel cars in Canada have been supplied by Mercedes-Benz of Untertuerkheim, near Stuttgart, Germany.

Now the diesel engine usually costs more to make than an equivalent gasoline engine. Thus there is a capital charge that must be written off before the saving in fuel cost can be enjoyed. The largest maker of small, interchangeable gasoline and diesel engines in the U.S.A. puts this additional cost at $300 an engine. About two thirds of this is the additional cost of the injection pump and nozzles required by the diesel. The remainder represents the cost of better bearings to withstand higher pressures, the fuel pump driving gears, a larger starting motor and so on.

But, in the case of the Mercedes-Benz cars, which we are considering at the moment, the price is the same

whether the car has a diesel or a gasoline engine. Thus, to the purchaser of a car of this make, there is every incentive to specify the diesel.

Historically, Canada got off to an early start in the development of diesel-engined cars. One was built by André Attendu and was running about the streets of Montreal in 1924. This was, of course, an experimental car and some years ahead of its time; the first diesel car offered for sale was the Mercedes-Benz of 1936.

In fact, the development of a diesel engine suitable for use in cars was a problem far tougher than it seemed in 1924. For one thing, the injection equipment of the diesel still costs as much to make as the manufacturing cost of the engine used in a Chevrolet or Ford. The fuel it has to measure out at each injection has a volume about equal to that of a small grain of rice. This charge of fuel is pumped into the combustion chamber under a pressure of about 9,000 psi, as often as 30 times a second. To maintain accuracy of injection, the machining of the injection pump plunger and barrel must be held to a tolerance measured in hundredths of a thousandth of an inch.

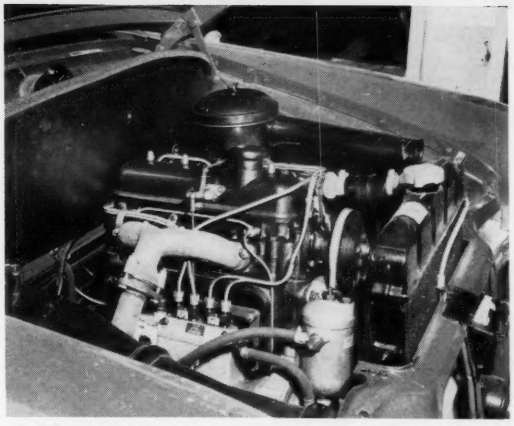
Next, the combustion chamber for a small engine presents a difficult problem. Its small dimensions and the high compression ratio (as high as 20 to 1) required to ensure satisfactory starting from cold, combine to give it a very high surface-to-volume ratio, so that it is difficult to avoid high heat losses and incomplete use of the air charge. In a cylinder of this size, the compression space has a volume of about 1½ cu in. and it is all too easy for a good deal of this to get lost in clearances.

In the Mercedes-Benz engine, a precombustion type of combustion chamber is used. With this arrangement, the fuel is injected into a small cell which contains about 30% of the air charge. Here it ignites by contact with hot surfaces (assisted by electric heating plugs when starting from cold) and rushes over to the cylinder through a restricted passage, to complete its combustion above the piston.

In the Austin engine, the Rocardo chamber is used. Here the cell into which the fuel is injected is spherical, to encourage a violent air swirl; it contains as much as possible (usually about 85%) of the air charge. In this chamber too, electric plugs are used for cold starting and combustion is completed in the space above the piston. The Standard engine uses the Freeman Sanders chamber, with a somewhat similar arrangement, but a part of the entrance passage to the combustion cell is formed by the edge of the piston and the swirl direction is reversed as the piston approaches its top centre.

In a way it is curious that these comparatively complex combustion chambers are used in diesel engines for cars. The vast majority of diesel truck and bus engines use the simple, open chamber, in which the fuel is injected into the space above the cupped piston. Small tractor engines also use the open chamber successfully, but it is true that they do not run at such high speeds as those required of car engines.

Since the diesel engine cannot make full use of the air charge, it must be slightly larger in displacement than a gasoline engine of equal power output. Another disadvantage of the diesel engine is that it is inclined to be rough when idling. Unlike the gasoline engine, which idles on a mere sniff of badly-diluted mixture, the diesel idles with a full air charge. Considerable resistance is offered to the flywheel in pushing the pistons over compression. This causes the engine to rock and, even when the engine is mounted on rubber, it is very difficult to prevent the vibration from making itself felt in the body and through the steering wheel. Again, all diesels tend to be somewhat noisy when idling.

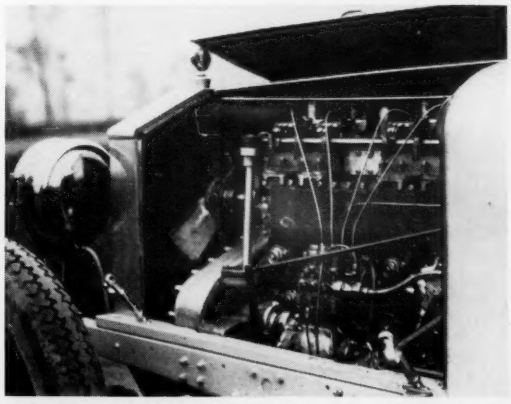


A Mercedes-Benz diesel installed in a Toronto taxicab.

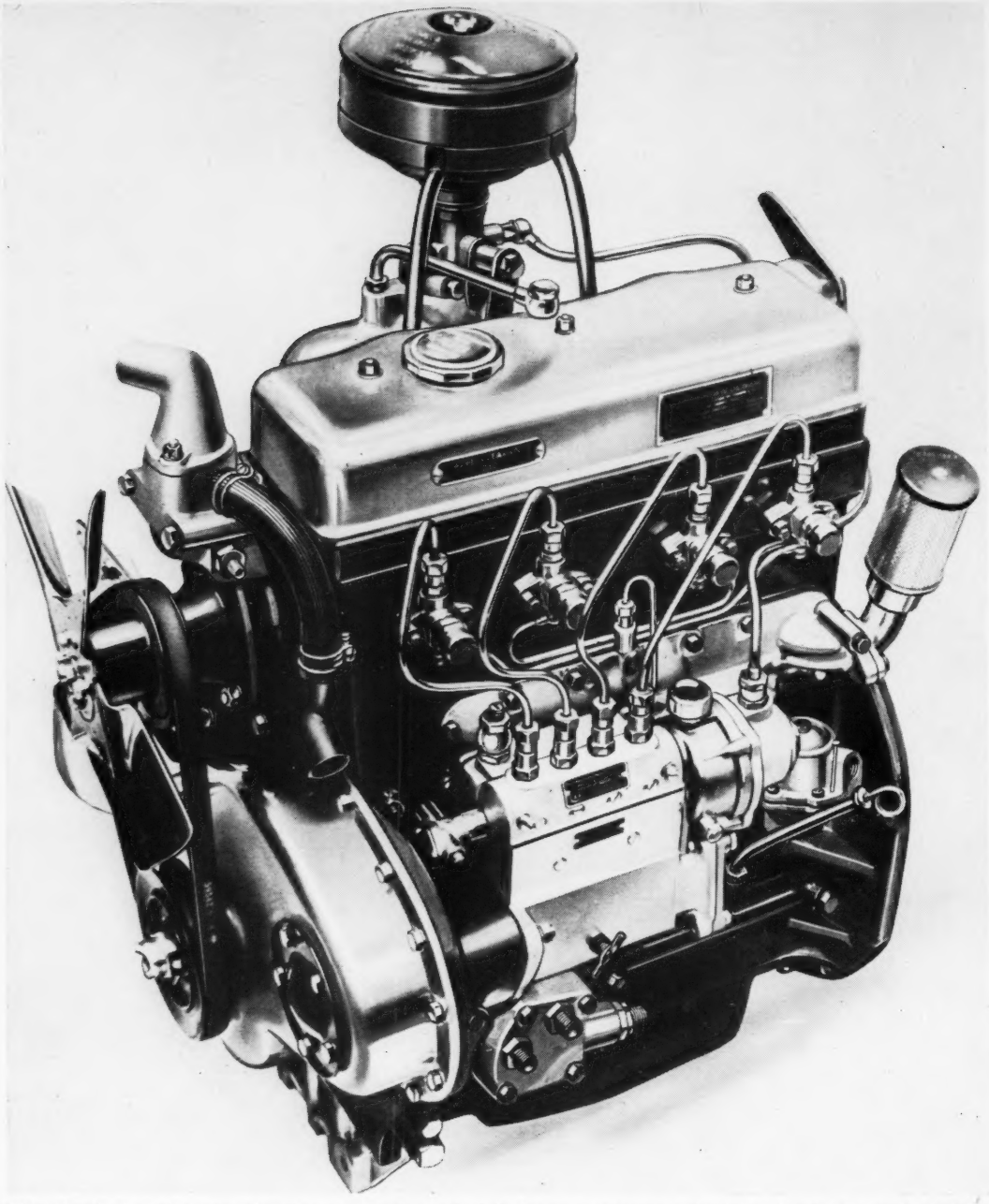
A minor point against the diesel engine is that its fuel is not as readily available as gasoline. In a pinch, however, the diesel engine will run on gasoline (the lower the octane rating the better), though its starting will be better if the tank is filled with gasoline before all the diesel fuel has been used up. Diesel fuel has, of course, a considerably lower fire risk than gasoline. There is an entire absence of dangerous concentrations of carbon monoxide in the diesel engine exhaust. Finally, records of large bus fleets show that the diesel is subject to less than half as many road failures as the gasoline engine. The writer's experience has been that fuel and ignition troubles, when they do occur, are much more easily diagnosed in the diesel than in the gasoline engine.

The various diesel automobile engines offered for sale in Canada, Great Britain and Germany are all of the four-cylinder type. They have cylinder dimensions of about 3 in. bore by 4 in. stroke, compression ratios of 17 or 20 to 1 and power outputs of from 40 to 55 hp at 3,500 rpm. These power figures seem low by comparison with the horsepower figures to which we have become accustomed in gasoline cars, but it must be remembered that the diesel engines are installed in comparatively small and light cars, whether taxicabs or for private use.

To sum up the advantages of the diesel engine for use in automobiles: (1) The diesel engine is capable of



André Attendu built this diesel engine and the car ran in the streets of Montreal more than thirty years ago.

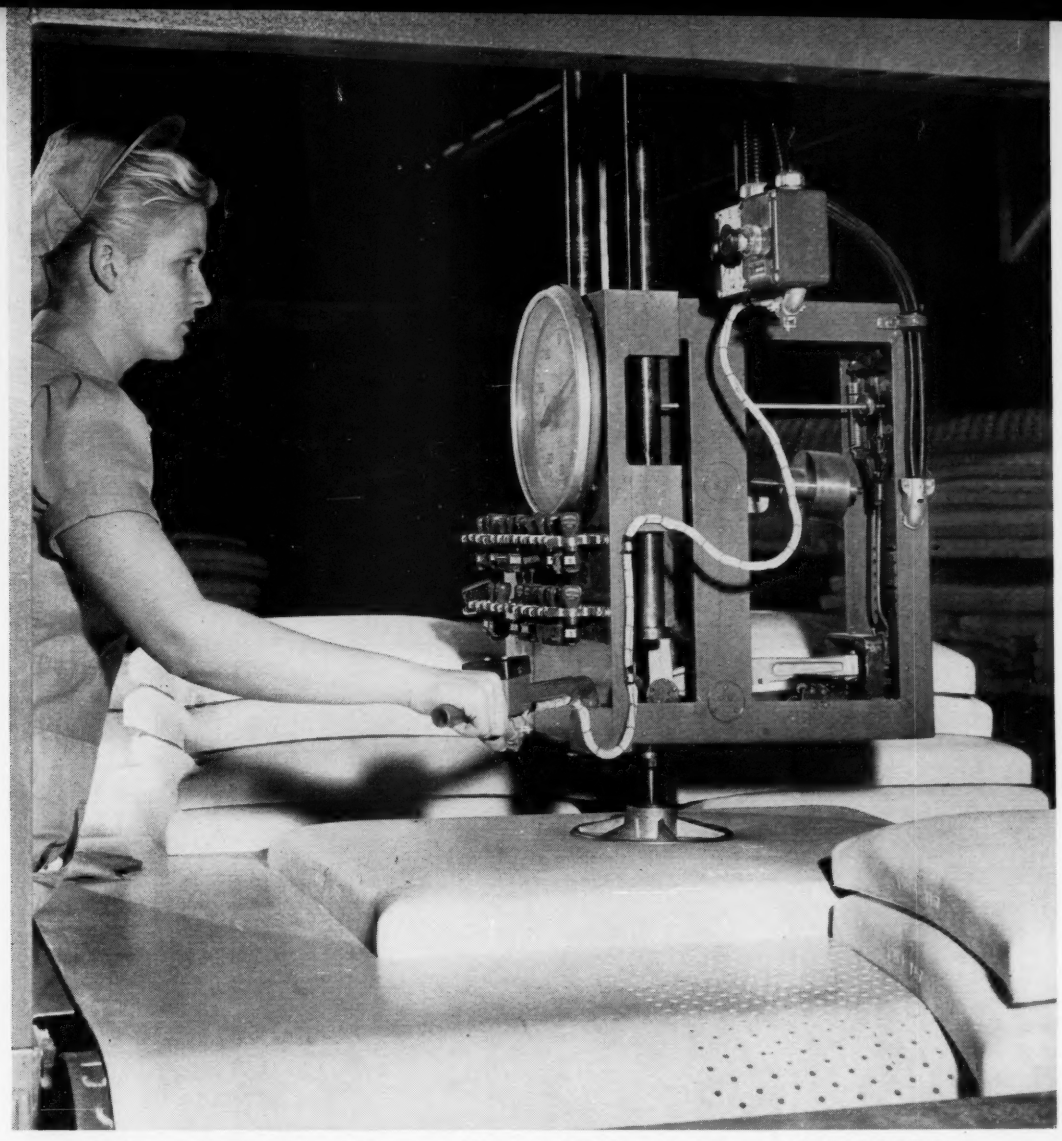


The Standard engine uses the Freeman Sanders principle for an arrangement similar to Austin's Rocardo chamber.

obtaining about twice as many miles per gallon as a gasoline engine in the same service. (2) Diesel fuel costs less than gasoline and is relatively fireproof. (3) The diesel engine does not produce CO in the exhaust, is more reliable in service and its troubles are more easily diagnosed.

Against the diesel engine: (1) It is, in general, more costly to produce than the gasoline engine, although this does not apply to the only diesel-engined car now offered for sale in Canada. (2) When idling, it is rougher and somewhat noisier than a gasoline engine. (3) It is sometimes difficult to start when chilled through to temperatures below freezing. (4) Its fuel is not as generally available as gasoline, nor is roadside service so widely available.

To the automotive engineer, this trend toward the use of diesel engines in cars is most interesting. To the private car owner, however, his car is a very personal thing; he wishes to know how the engine feels and how it responds when he puts his foot down. So, whatever the pros and cons, you will probably want to take a ride in a diesel car and find out for yourself. ★



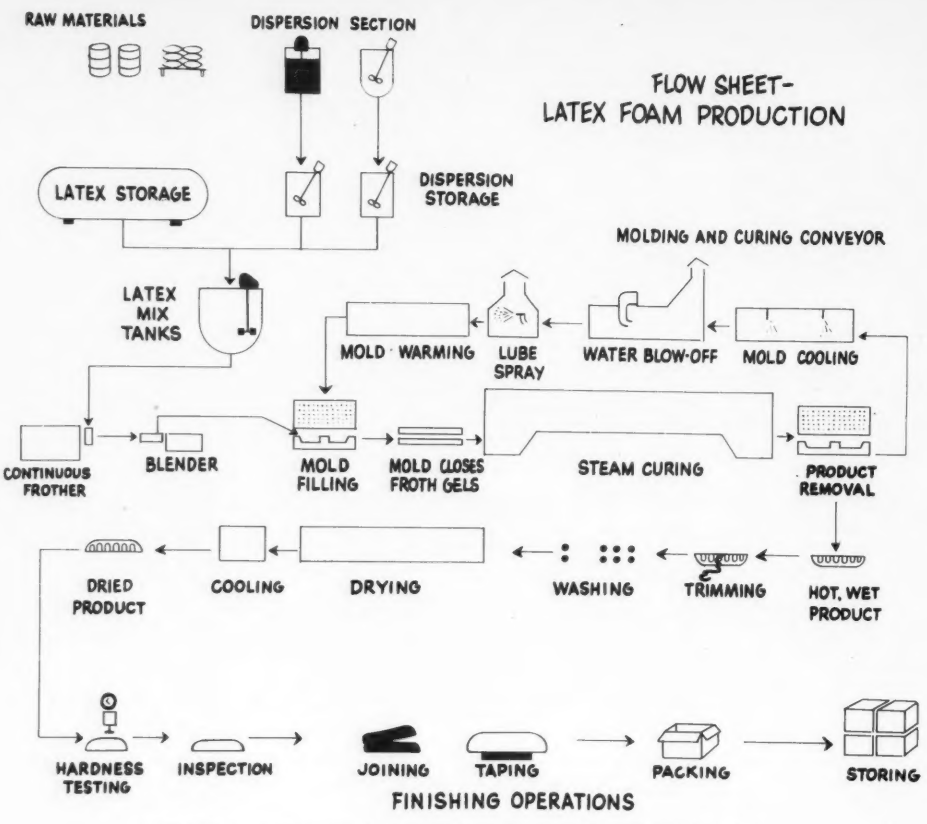
Quality control takes place at this compression tester which shows the firmness of the finished Pillofoam.

Pushbutton foam rubber is in Canada

Automation, ingenious layout and gravity feed have combined to bring high quality at low cost to the foam rubber products of this new Canadian plant

What has been called the world's most modern plant for the production of latex foam is now working on a 24-hour basis at Whitby, Ontario, Canada. It is the property of Dunlop Canada Limited, whose parent organization originated latex foam in 1928. It is devoted exclusively to manufacturing a wide variety of cushioning shapes and sizes of Pillofoam brand. This process of foaming latex involves mechanical frothing, with the incorporation of a gelling agent such as silicofluoride. It is in contrast to the gelling frothing procedure, where hydrogen peroxide and an oxygen releasing activator are introducer into the compounded latex. The frothed compound is poured into molds, where it sets up and holds its shape like meringue in a few minutes. Curing follows immediately.

In the chemical foaming method the latex mix, plus the foaming agent, are placed in a mold which is then closed. The mixture foams, is frozen, gelled by



This diagram illustrates the process from raw material to finished product.

the introduction of carbon dioxide gas, then cured. Dunlop favors its process as simpler, faster, more accurate and cheaper.

Latex is received at Whitby in 9,000-gallon railroad tank cars and 3,000-gallon tank truck loads. Truck shipments come some 600 miles from Boston, two round trips being scheduled weekly. Pressure unloading is to 20,000-gallon indoor storage tanks. To prevent creaming of the latex and surface coagulation, these tanks are equipped with agitators of the slow speed turbine type rather than high speed propeller agitators. The next transfer is by pressure to 2,000-gallon compounding tanks. These have their tops extending through openings in the floor above. On this floor is a mezzanine. It houses a row of smaller tanks in which various aqueous dispersions are stored.

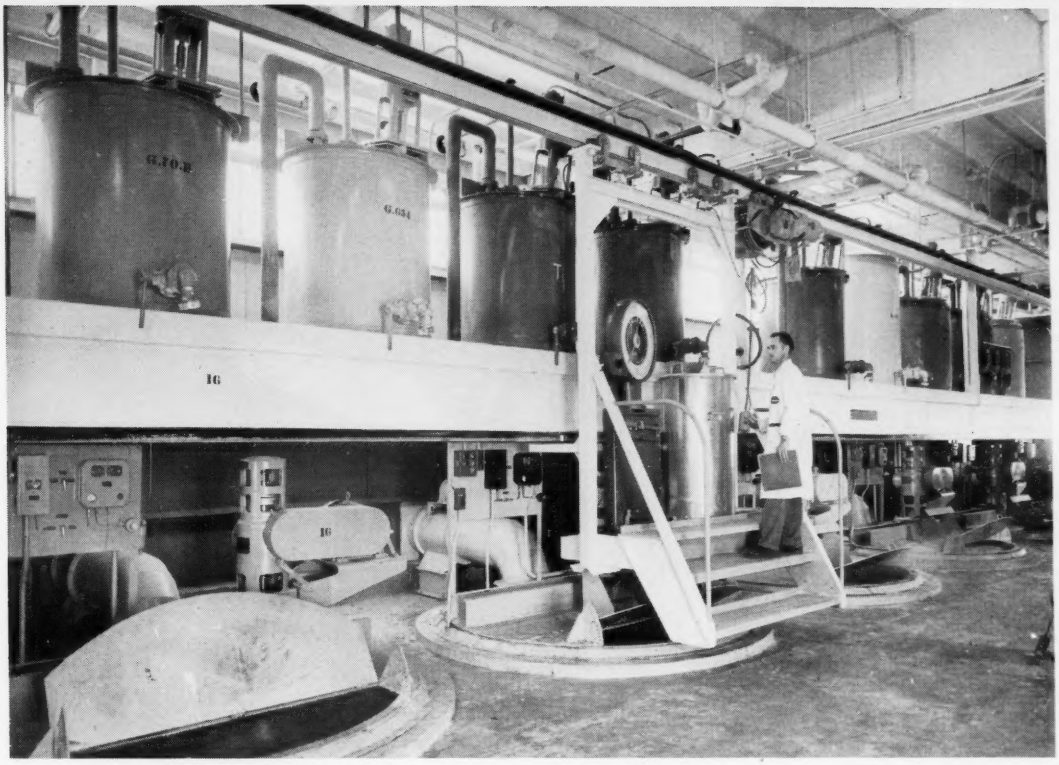
Raw materials, other than latex, are handled in pallet loads, using fork lift trucks. Loads are stored on pallets on the third floor. This, incidentally, is the only section of the plant which is above one story. Here are prepared aqueous dispersions. Equipment includes slurry tanks and a battery of Szegvari attritors. Dunlop chose these attritors in preferenct to standard ball mills because of their ease of operation and their effectiveness in grinding powders to a very fine particle size for good dispersion in less than 24 hours. After preparation the dispersions are drained or pumped into the mezzanine-mounted storage tanks on the floor below.

An interesting feature of third floor operations is a special kettle devoted to the manufacture of liquid soap. This large tank is jacketed, and ethylene glycol is pumped through the jacket to control the temperature of the soap making ingredients. The glycol can be heated or cooled rapidly by diverting it through a steam heat exchanger or a cold water heat exchanger. Required coolant diversion is handled by an automatic temperature controller-recorder.

As will be realized from the foregoing, the entire compounding section has been designed to reduce to a minimum physical labor. It is built to take fullest advantage of the cheapest, smoothest moving force . . . gravity.

Each dispersion storage tank is painted a separate color to identify instantly its contents. Each has an individual motor driven agitator to ensure maintenance of uniform solids suspension. Each has its own automatic temperature control.

Great care is exercised in the treatment and conveyance of water used in the dispersion. A permutit demineralizing system provides the equivalent of distilled water. It employs two ion exchange beds, one to remove metal ions, the other to remove acid ions. All supply lines are of stainless steel with welded fittings. Water is autostop-metered to assure the delivery of exactly predetermined quantities to slurry tanks, attritors, etc.



Each dispersion storage tank is painted a different color so that its contents can be quickly identified.

The foamed latex process uses mechanical frothing with a gelling agent

As the mold approaches the pourer he fills it through a plastic hose and spreads and levels the latex foam.

Materials from the dispersion storage tanks are drawn off for addition to the latex in the compounding tanks. This calls for precise weighing, and the company does the job with despatch. There is no pumping, no hand carrying, no waste. Instead, a travelling scale and weigh bucket car is utilized. This is suspended from a monorail fixed in front of and above the dispersion tank line-up. The operator travels up and down the line at will. He draws off each dispersion separately, while the scale's dial shows him the weight loaded and checks him with a printed record. He then travels to the particular compounding tank he is servicing and drains the dispersion into the latex.

Ammonia is added to latex as a preservation during shipment. Most of this must be driven off before compounding can take place. This involves stirring, in each compounding tank, some 10 tons of latex. Agitation is provided by 2-speed off-centre paddles. This gives a top-to-bottom agitation without the use of baffle plates and with a complete absence of splashing. The cyclic upturning of fluid changes the surface area continuously. As the ammonia fumes are exposed to the surface area, they are carried away by exhaust currents. The compounding tanks have wide hinged lids, and the ammonia exhaustion system relies on a large volume of low velocity air being drawn across the surface.

Following ammonia removal, vulcanizing ingredients are added. Then the latex, under agitation, is held for a further 24 hours to mature. Very accurate temperature control is demanded during the maturing process. To gain this, each mixing tank has its own separate water jacket system. The water in the jacket is recirculated continuously. It can be heated by steam or electric heaters or cooled by admitting cold water. Mechanical refrigeration keeps the cold water at the necessary low temperature. Controlled temperature is held automatically through air top valves which are actuated by each tank's temperature controller. The operator merely sets the controls. The system does the rest.

Noteworthy is the fact that the compounding tanks are lined with a baked-on plastic coating which reduces coagulation markedly.

After maturing and final compounding, the latex is piped by gravity to the frothing station. A delay tank is used to provide additional temperature control. The company uses an Oakes frother. This is best described as a continuous mixer. In it latex and air are mixed at known, closely controlled rates under pressure. The Oakes unit had its beginning as a marshmallow maker, but it works equally well for foam rubber production. The mixer head produces a froth having a very fine and very uniform bubble size.

From the mixing head the foam passes into a blender of unique design. Its function is to mix thoroughly the gelling agents which are introduced into the foam at this stage by a variable speed diaphragm pump. Because of its remarkably simple design, this blender can be operated for long periods without disassembly for cleaning or other attention.

Molding and curing are completely conveyorized, and molds of all sizes pass a single frothing station. Here a pourer dispenses foamed latex from a long plastic hose after the fashion of a pastry cook dishing out whipped cream. Pallets, travelling on a conveyor, carry the molds. The bottom section of the pallet carries the mold bowl.

The top section of the pallet supports the mold lid, and is hinged to the bottom section of the pallet. A roller is attached to the front edge of the pallet frame's top. This roller follows a cam rail alongside the conveyor route, causing the lid to open and close automatically.

(Continued on page 86)

Tons of hot water are used to remove soap, excess curing chemicals and all traces of odor from the rubber.

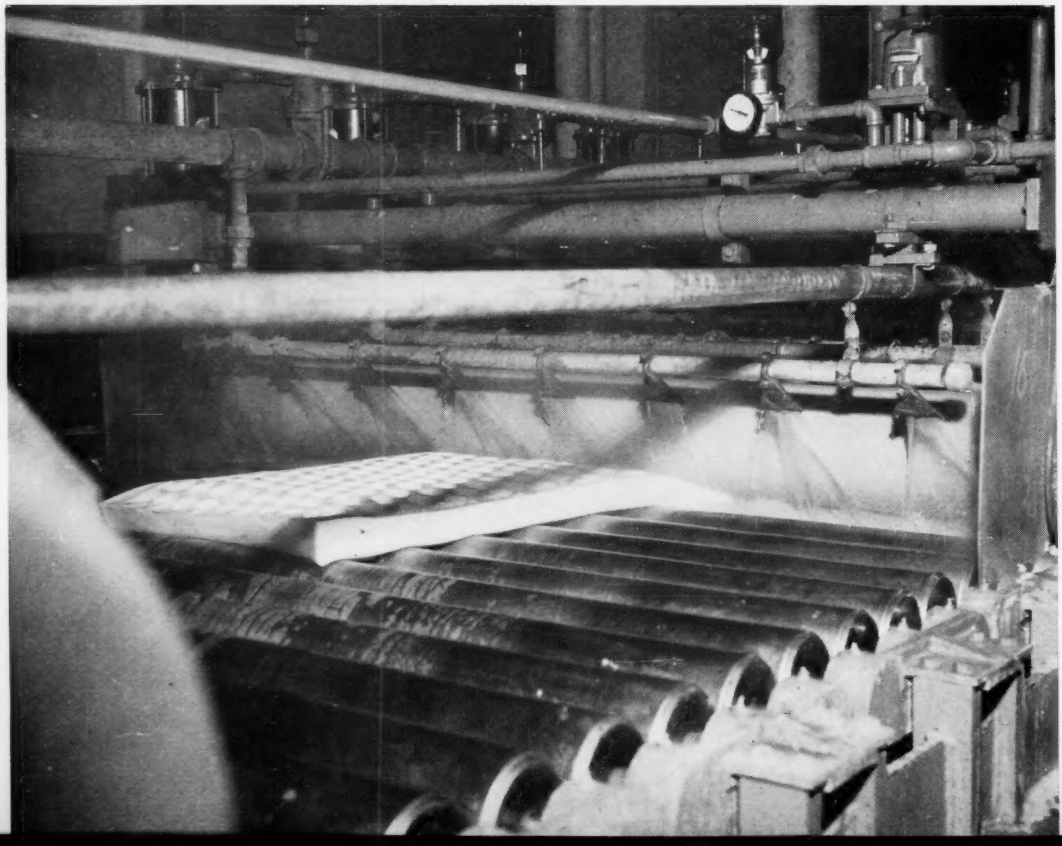
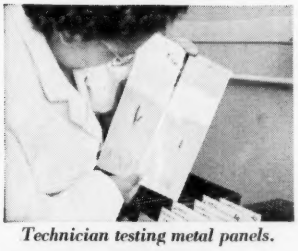


Photo courtesy of Steel Equipment Co. Ltd., Pembroke, Ont.

C-I-L FINISHES *add warm beauty to the strength of steel*



Technician testing metal panels.

Spraying C-I-L finish on Steel Desk

To enhance the appearance of their handsome office furniture, STEEL EQUIPMENT CO. LTD. relies upon C-I-L finishes. For on steel as well as wood, a C-I-L finish assures a wear-resistant surface of enduring beauty. C-I-L finishes are used on an amazing variety of wood and metal products . . . from pencils to pianos . . . from wires to washing machines.

To serve Canada's ever-expanding industry, the C-I-L Paint Research Laboratory is constantly engaged in developing improved finishes and finishing methods. Whether you make fine furniture or production-line merchandise, there's probably a C-I-L finish to meet your specific needs.

For Technical Information Bulletin No. 87 — Baking Metal Furniture and Cabinet Enamels — write: Canadian Industries Limited, Paints Division, Dept. 605, Box 10, Montreal, Que.

industrial finishes

C-I-L PAINTS

Getting down to the business of shifting snow from the side of a highway a blower shows off its long throw.

Blower to blast the snows of the world

This Canadian snowblower which had its origin in a Quebec barn more than

Ask a Canadian about winter and he'll probably say, "I don't mind the cold weather so much, it's the mess that the snow makes of the streets. Snow's fine for the kids who want to toboggan and I like to ski myself but it's a pity that all the snow can't fall on open ground."

Winter street-clearing has been a problem in most Canadian towns and cities ever since the horse and buggy era and it was in 1894 that a Canadian, who was later to take steps to find a solution, had his first brush with Old Man Winter.

Start of the invention

Eighteen-year-old Arthur Sicard worked on a farm in those days and one of his jobs was to deliver the milk to Montreal, five miles away. Since Quebec averages 111 in. of snow annually the winter route to Montreal was often closed to Sicard's horse and wagon for days on end. It was then that the seed of an invention took root and began to grow. The young Sicard converted a barn into a workshop and began an experiment in building a snow plough that would outperform those in use.

The next real step came when a proud neighbor showed Sicard his new thresher. The machine chopped the heads off the wheat and blew the grain through a duct into a cart. As Sicard admired the thresher it occured to him that the principle of this machine might be applied to scraping and chopping packed snow and then blowing it clear of roads and sidewalks. The idea was certainly worth a try and Sicard returned to his workshop to put it into practice. There he built a snow-blower where the "chewing" was done by a rotating arm and a fan behind it threw the pulverized snow and ice sideways through an ejection chute. By the time the chill winds of winter brought snow to Quebec Sicard had his prototype ready for trials and took it out on the roads.

Its success was limited. While it could handle thin layers it balked at the man-sized drifts. The reason was simple. There was insufficient power.

For several reasons, among them a lack of funds, Sicard shelved his plans for a snow-blower, went into the construction business and later became a roads contractor. It wasn't until 1924 that he took up the fight against snow again.

In the winter of 1925-26 Sicard's first commercial snow-blower took its maiden run down Bennett Street. Built around a conventional truck, the machine had two wide-bladed augers and a fan driven by a powerful engine behind the cab. Best of all — it worked, and worked well. Montreal's city officials were impressed but unwilling to open their purse strings for such a specialist machine. Sicard had to wait two years for the suburb of Outremont to buy the first snow blower. After many years of service this original machine now waits out its dotage in the Sicard Inc. museum. The second machine (built to the same model) has enjoyed no such retirement and still works near Ste. Therese.

Sicard lived to see his idea grow into a successful

A detachable type of small snowblower here shown fitted to the front end of an agricultural wheel tractor.

sixty years ago now sharpens its teeth on drifts all around the world

industry manufacturing a wide range of machines, not only for the Canadian market but also for export to almost any country where snow is a problem. He died in 1946.

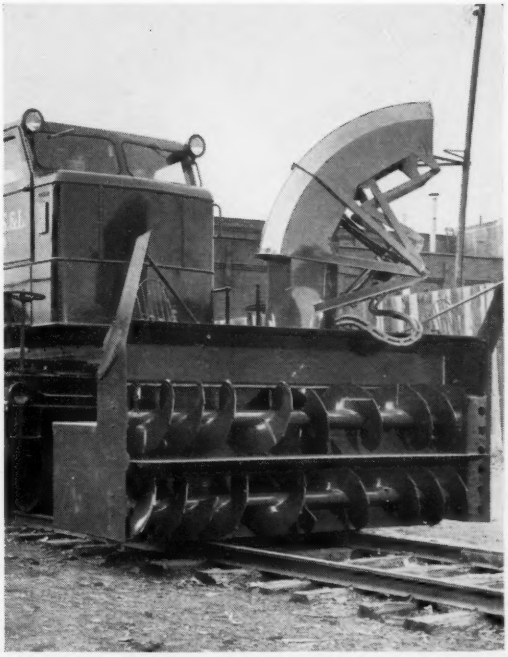
Snow-blower trucks are now Sicard-built with all-wheel drive and low-geared transmission allowing speeds from about half a mile an hour to 35 mph. Steering is right-handed to allow the driver to follow the curb.

The front assembly consists of two horizontal augers (balanced to reduce vibration), a blower and a truck-loading chute. This unit is hydraulically lifted or lowered into working position and the augers, as before, break up and feed the snow or ice to the blower. The blower casing can be rotated to direct the snow stream at any angle or pump it vertically into the loading chute for truck pickup. Everything is controlled from the cab.

The latest machine

The company's latest machine is a far cry from the one that first showed its paces to Montreal officials. Designed for airport clearing and boasting an impressive 1,100 hp it can scurry over the runways at 25 mph, gobble up 5 in. of snow and blast it 300 ft. through the air.

Today the city of Montreal owns more than 45 Sicard snow-blowers and on the Montreal-Quebec highway, scene of Sicard's first idea, the milk can now go through on time.



Yet another sign of the Sicard blower's versatility is this application for clearing snowbound railtracks.

Quotes

Points from current papers and speeches

Box beams

The use of box beams with thin walls in structural design gives rise to a range of special problems in strength analysis. The Britannia tubular bridge and, more particularly, aircraft wings, are examples of such beams, of approximately rectangular cross section. Provided certain conditions are fulfilled, the Batho-Bredt torsion and conventional bending theories give a reasonable prediction of stress. Perhaps the most important such condition is that the section under consideration is removed from the effects of supports and applied loads. If this is not so, a modification to the elementary stress distribution occurs, an important instance of which is at the root of a cantilever. This modification is known as a constraint effect. A paper by D. Howe and K. H. Griffin, given before **Section G** of the **British Association** (and published in **Engineering, August 10, 1956**) reviews methods which have been used to consider these constraint effects, and further solutions based largely on Castigliano's principle of minimum strain energy are suggested. Particular emphasis is placed on the case of a swept aircraft wing, the effect upon the stress distribution of concentrated end-load carrying members and the rate of die away of the constraint from the fixation being investigated. Constraint effects are shown to be of importance in aircraft wing structures, particularly in the swept case. The effects of concentrated booms in reducing constraint effects is demonstrated. In certain instances, comparison is made with experimental results. Good agreement is obtained.

Friction material

In an SAE lecture by **W. H. DuBois** of **Bendix Aviation Corporation,** a brief history of Cerametalix and the reasons for its development were given. As its name implies, a cermetallic material is a composition of ceramic and metallic particles. Some of the theories on friction materials and how these have influenced design and development were presented, as well as the desirable characteristics of a friction material. These characteristics were compared point-by-point with Cerametalix.

Near absolute zero

The behavior of metals when tested in tension at temperatures approaching absolute zero was described by **Z. S. Basinski,** Division of Pure Physics, **National Research Council** at a recent conference on metal physics held at the Royal Military College, Kingston, Ont.

Sudden discontinuous drops in stress were observed during the deformation of a number of materials (high purity A1, solution treated 24S aluminum alloy, Ta, Fe) in the liquid helium range.

It has been shown that the deformation proceeds by slip and that the phenomenon is due to instability of plastic flow at very low temperatures, caused by thermal softening of the material. The observed values of drops in stress agree well with those calculated on the hypothesis of localized adiabatic deformation; the observed transition temperatures (between smooth and serrated flow), however, lies below the expected one.

Larger rim width ratios

The fast movement of large volumes of earth at low cost has been a development which has taken place almost entirely in the last 25 years. The use of specially designed earth-moving machines has made this possible. One important part of these machines that has had to be developed, along with the machine itself, is the tire equipment.

The small dump truck tire, used usually as duals, the airplane tire and the farm-type tire were all starting places from which has come the giant earthmover tire of today. The wide base tubeless tire is one of the most recent developments.

Neither the wide base principle nor the tubeless principle is new, but both are logical steps in the constant effort to move earth quickly and cheaply.

What is a wide base tire? To answer this, it is necessary to take a look at one of the aspects of tire design. The ratio of the rim width to the inflated tire section width is called the rim width ratio.

Passenger car tires in the supercushion type have a rim width ratio of 70%-75% and are run at low pressure (24 psi for most applications). These are the sizes on 1956 production models. The sizes which were used before the supercushion type came in had a ratio of about 65%-70% on the preferred or widest recommended rim.

The conventional earthmover tires in 16.00 and larger sizes (the so-called A-2 sizes) have a ratio of 68% on the recommended rim.

Several years ago it was found that the extra low-pressure wide-section airplane tire, such as the 56-in. and the 65-in. sizes, would give good flotation in some special applications for work in sand and very soft soils. The rim width ratio of these tires runs as high as 97%.

It was also known that a number of equipment distributors and operators had widened out rims for 21.00 and 24.00 tires (and some other sizes) as much as six inches and found improved performance. This was based upon go and no-go testing.

It was also found that because of the increased flotation, a higher gear could be used in soft places, with resulting increased production.

There was a need for an earthmover tire designed with an increased rim width ratio, or wide base, and capable of performing satisfactorily at lower pressure. The tire should also be made for conventional-type runs. Airplane tires do not fit standard earthmover rims.

The approach was to redesign the conventional tire to obtain improved performance characteristics without getting so far from the established and proven practices that early failures would be expected in severe or possibly even in normal operations. The tire should have a reasonably increased rim-width ratio, a wider tread and use lower inflation pressure and, at the same time, not sacrifice durability or length of service. These changes in construction would affect the flex characteristics of the tire, but it was felt that with improved tire fabrics and compounds and constructions, such changes could be made without reducing tire life.

With these things in mind, a range of sizes was projected with a rim width ratio of 84% and experimental sizes were produced for test, details of which were given by **W. P. MacKusick of Goodyear Tire and Rubber Co.** at an SAE lecture.

Rim width was increased from 17.00 in. (Tire & Rim Association standard rim) to 25.00 in. The tread arc width was increased from 22 in. to 30 in. and in order not to buildup the gauge of rubber at the shoulder to a dangerous extreme, the tread radius was decreased somewhat.

Silicon rectifiers

The availability of silicon diodes as an additional tool for rectifier design presents a new challenge to design engineers. As the newest and most promising addition to the rectification field, silicon offers many unique and noteworthy properties. It opens a new dimension in temperature operating range, peak inverse voltage ratings, forward-to-reverse resistance ratios, power handling capabilities and miniaturization compared to other solid state rectifying devices.

An article by Harry Nash in **Silicon Rectifier News, August 1956,** presents some of the underlying properties of silicon diodes that must be considered to assure optimum performance and life in any specific application.

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G-E CARBOLOY THERMISTORS are circuit elements with a highly sensitive response to minute changes in temperature. They have a negative coefficient of resistance — *resistance decreases with increased temperature* — and, their temperature coefficient is much larger than that of any other known material. These features, coupled with excellent stability and aging resistance, offer industry and science the opportunity to detect, measure and control energy to a degree never before economically possible.

Carboloy Thermistor applications can be divided into two broad classifications, depending upon the operating characteristics of the element used and the functions performed. These are determined by whether: (1) the element is controlled by ambient temperature; or (2) the element is heated by the current in the circuit with which it is associated. The first includes applications involving temperature measurement and control, and temperature compensation. The second, covers uses involving voltage-current and current-time characteristics; such as time delay devices for relay operations, timing devices, sequence switching, safety and warning circuits, voltage regulators, flow meters and vacuum gauges.

✓ CHECK THESE FEATURES

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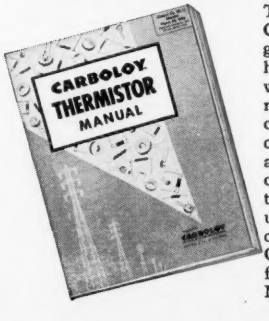
2. **Response to minute temperature changes.**
3. **Permits local or remote temperature measurement.**
4. **Offers temperature control never before practical.**
5. **Can eliminate mechanical timers.**
6. **Can eliminate current surge in electrical circuits.**
7. **May be used with electrical conductors to compensate for changes in their resistance due to temperature changes.**
8. **Will reduce cost, size and weight of products and processes.**
9. **They last indefinitely — need no maintenance.**

CARBOLOY THERMISTORS

Free Technical Manual Gives Application Data and "Ideas"



This free technical book, Carboloy Thermistor Manual, gives extensive information helpful to persons concerned with the design or improvement of products and processes. It includes basic circuits and performance curves, and "idea" circuits, with curves, are provided as a guide to the best utilization of the unusual operating and physical characteristics of G-E Carboloy Thermistors. Write for this 56-page manual today. Mail the coupon below.

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New booklets and books written for you

Power supplies

A new booklet on fixed-output, constant voltage d-c power supplies is available from **Sola Electric Co.,** manufacturers of constant voltage transformers and lighting ballasts.

The booklet gives technical data for six standard-design, regulated d-c power supplies for intermittent, variable and pulse loads or high-amperage loads. The text is amply illustrated with photographs, schematic drawings and tables showing mechanical and electrical specifications and performance data. These d-c power supplies combine a constant voltage transformer, a germanium power rectifier and high-capacitance filter without choke.

The theory of operation of these unique d-c power supplies is covered in detail in the booklet, with oscillograms, schematic diagrams and charts showing output voltage curves for a typical power supply assembly at various loads and supply line voltage. Ratings for the six stock d-c power supplies are shown on specification charts. More than 30 other ratings are offered on special order.

Advantages of the Sola d-c power supplies include compact size and low weight in proportion to power output, unusual short-time or transient overload capacity without oversize components, and exceedingly good load regulation over the entire operating range. The assemblies can be used in series or in parallel or in three-phase operation to increase capacities of the six stock sizes. (200)

Liquid level gauge

A newly revised catalogue No. 291 completely covers the latest designs of the **Jerguson Gage and Valve Company** in remote reading liquid level gauges. Details are included of the newly developed Red Flasher Truscale, the scale of which flashes continuously in red for a positive warning when the boiler water level gets too high or too low. The catalogue is illustrated with photographs and engineering drawings, and covers remote reading gauges in four pressure groups from under 900 psi to over 1,500 psi. (201)

Bobbins and washers

A new four-page technical bulletin containing maximum and minimum wall thicknesses, core lengths, core sizes and flange sizes on nylon bobbins; and maximum and minimum thicknesses, outer and inner diameters, and tolerances on nylon washers for a wide range of electrical uses is now available from **Cosmo Plastics Company.** (202)

Cotter data

Dimensional data and price information of fourteen external cotters which the company considers standard are presented in a data sheet recently made available by the **Hunter Spring Company.** Pin dimensions for each cotter are also given. (203)

Plastic tooling

Now available is an illustrated eight-page publication designed to fill the need for a single source of reference on this vital phase of industrial production.

The booklet, which is published by the **Marblette Corporation,** is a distillation of experience accumulated by the company in collaboration with tool and die shops and other users of plastic materials.

The digest summarizes existing applications of plastic tooling for metal-forming and plastics-forming and in foundry practice. Factual attention is given to time and labor savings, easy handling and storage and quick design changes. Guidance is given in selecting suitable methods for constructing plastic tools, with descriptions of casting and laminating and combinations of these procedures. The length of run that may be expected from plastic dies in developmental work and in actual production are outlined, with advice on the preparation of heavy-duty tools.

Capsulated descriptions are included of the various thermosetting materials in phenolic resin and epoxy resin lines, comprising casting, laminating, troweling and splining compounds; foam resin; and accessory materials for mold preparation and mold release. Easily read charts and tables show at a glance the resins and production methods to fit specified applications, and the percentages and curing methods of the hardeners used with each resin. (204)

Spray lubrication

A new, eight-page brochure (Bulletin No. 60-A) provides complete information on the **Farval Corporation** spray lubrication systems for open gearing and slide surfaces. Descriptions are included of manual and automatic systems and component equipment, with schematic layouts as well as actual application views.

Servo analyzer

In solving a control system problem, the engineer carefully selects the type and nature of system to be used. Whatever the combination of mechanical, electrical, pneumatic or hydraulic requirements, an open loop system must be carefully calibrated to deal with all the anticipated standard conditions. Similarly, a closed loop system (based on feedback to regulate its output for all conditions) must be designed to meet the standards of stability, accuracy and response time, set by the original problem, and yet avoid self-exciting oscillation. The engineer determines the ability of his system to meet such specifications by measuring the changes in phase and gain which occur when signals of various frequencies are fed to his design.

The Servoscope servo analyzer, details of which are given in **Servo Corporation of America** leaflet TDS-1100, is an instrument for this purpose. It combines a sweep generator and multiple signal generator with a calibrated phase shifter. It delivers either a sinusoidal modulation in a suppressed carrier envelope, sinusoidal or square wave signal, at the desired frequencies to the system under test. It then uses that signal, as modified by the system, to measure changes in phase and gain which occur as the input frequency is changed. The engineer can now safely evaluate the behavior pattern of his system for its ultimate operating conditions. (205)

Belt conveyor

A new pamphlet describing the Tru-Track belt is available from **Sandvik Canadian Limited.** This type of belting is supplied in carbon as well as stainless steel and finds many uses in the various industries ranging from food plants to automotive plants. The stainless steel type is, of course, suitable for the food handling industry, since there is no contamination and the belt is very easy to keep clean. The carbon steel belts are suited for handling small machine parts, because the belt surface resists scratches and at the same time provides good storage for parts moved between different operations.

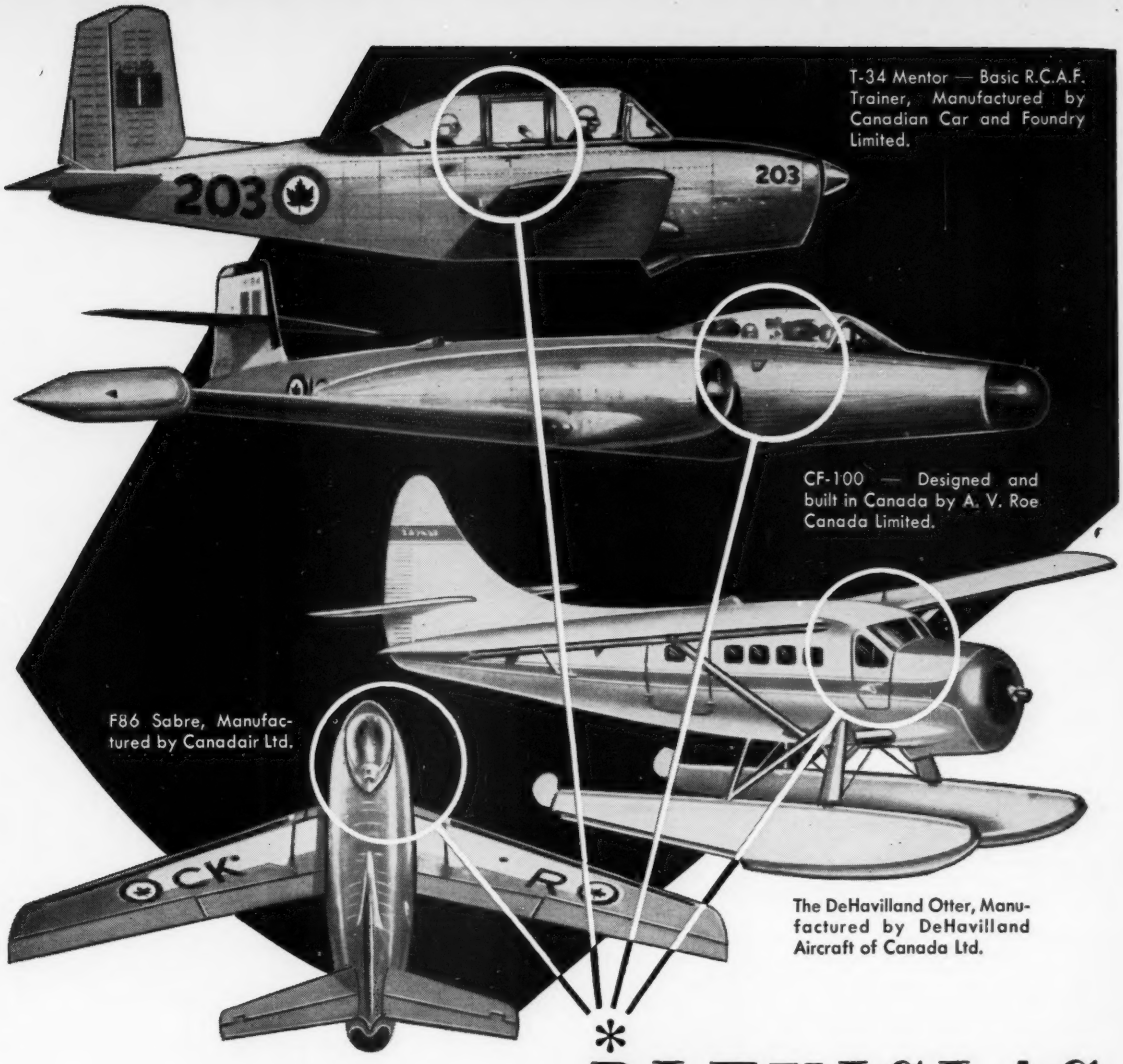
The design shows positive drive and positive guiding, which means that the belts can run very close to surrounding machines. The belts are very simple to install and require little maintenance.(206)

KWIZ KORNER

Do you know what these are?

1. Parallelopiped
2(a). Tungum
2(b). Tungsten
2(c). Tung Oil
3(a). Solenoid
3(b). Solidus

Answers given on page 79


T-34 Mentor — Basic R.C.A.F. Trainer, Manufactured by Canadian Car and Foundry Limited.
203
203
CF-100 — Designed and built in Canada by A. V. Roe Canada Limited.
F86 Sabre, Manufactured by Canadair Ltd.
CK
R
The DeHavilland Otter, Manufactured by DeHavilland Aircraft of Canada Ltd.

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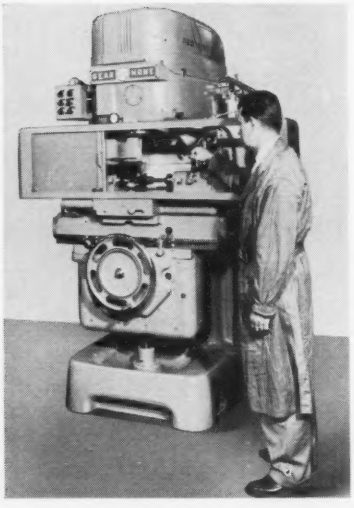
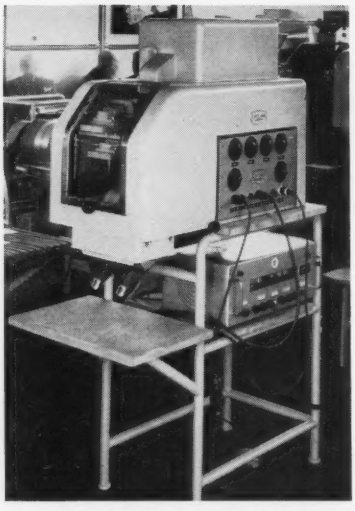
Design news in pictures

Some modern designs making news today



Honey of a honer

A recent development by National Broach and Machine Co. is this Red Ring gear tooth process which applies honing principles to finishing. (207)

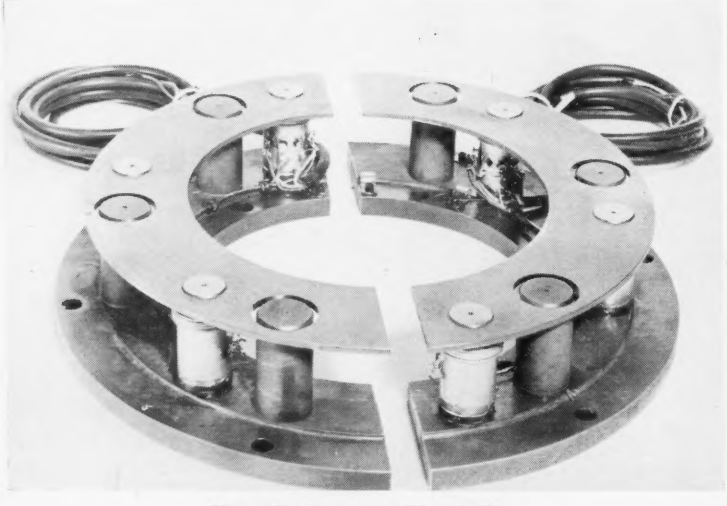


In lieu of fingers and toes

This new machine from Germany can count electronically uniform small articles of the same shape such as metal pieces, buttons and tablets. (208)

Bicycle with dimples

The problem of brazing a reinforcement piece into the top of a bicycle saddle post was solved by dimpling the tube and nesting the brazing. (209)



Thrust loads measured in a turbine

Designed for continuous electrical measurement of thrust loads in steam turbines and to warn of overloads, two of these two-segment units incorporating six columns with Baldwin SR-4 strain gauges are used in the Kingsbury thrust bearing of a turbine in order to measure two-directional thrust. (210)

Acrylic in extrusion

These are samples of extruded acrylic sheet. The extrusions are much lower in cost than cast sheet and suit many product design applications. (211)

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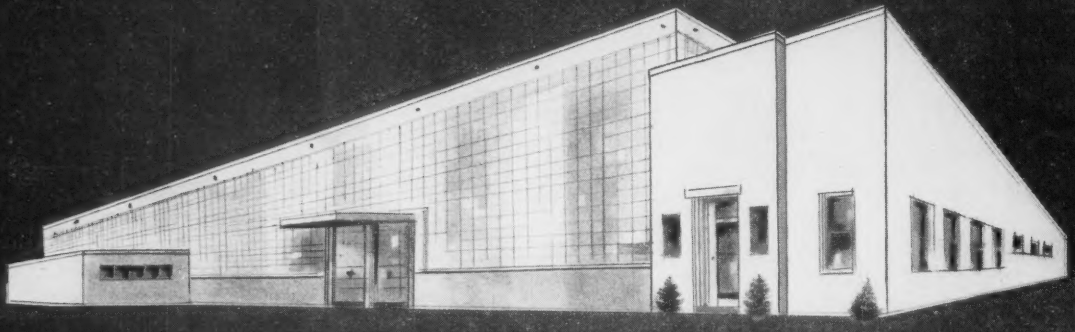

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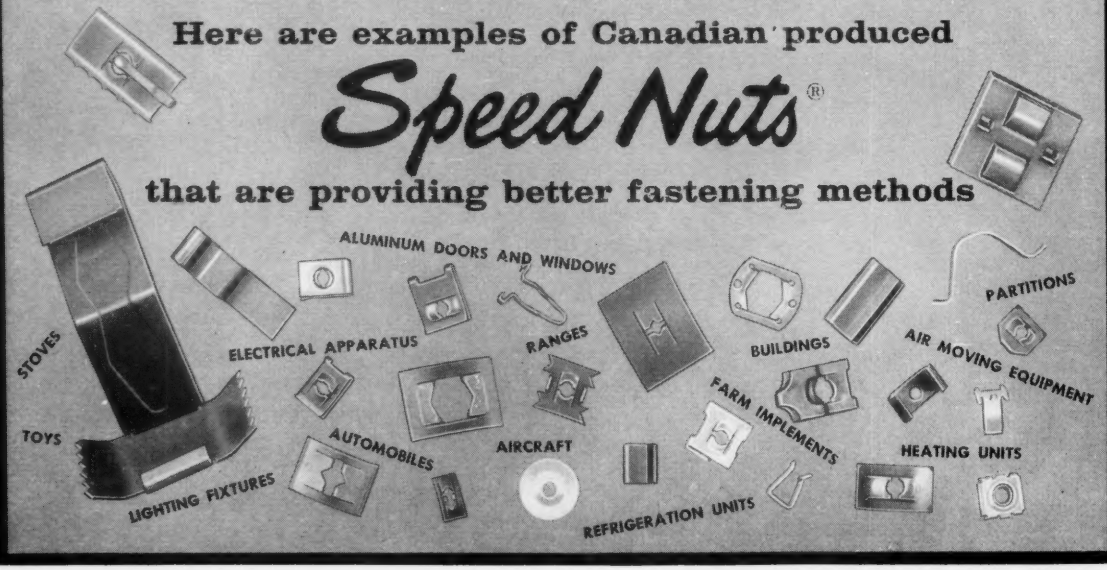

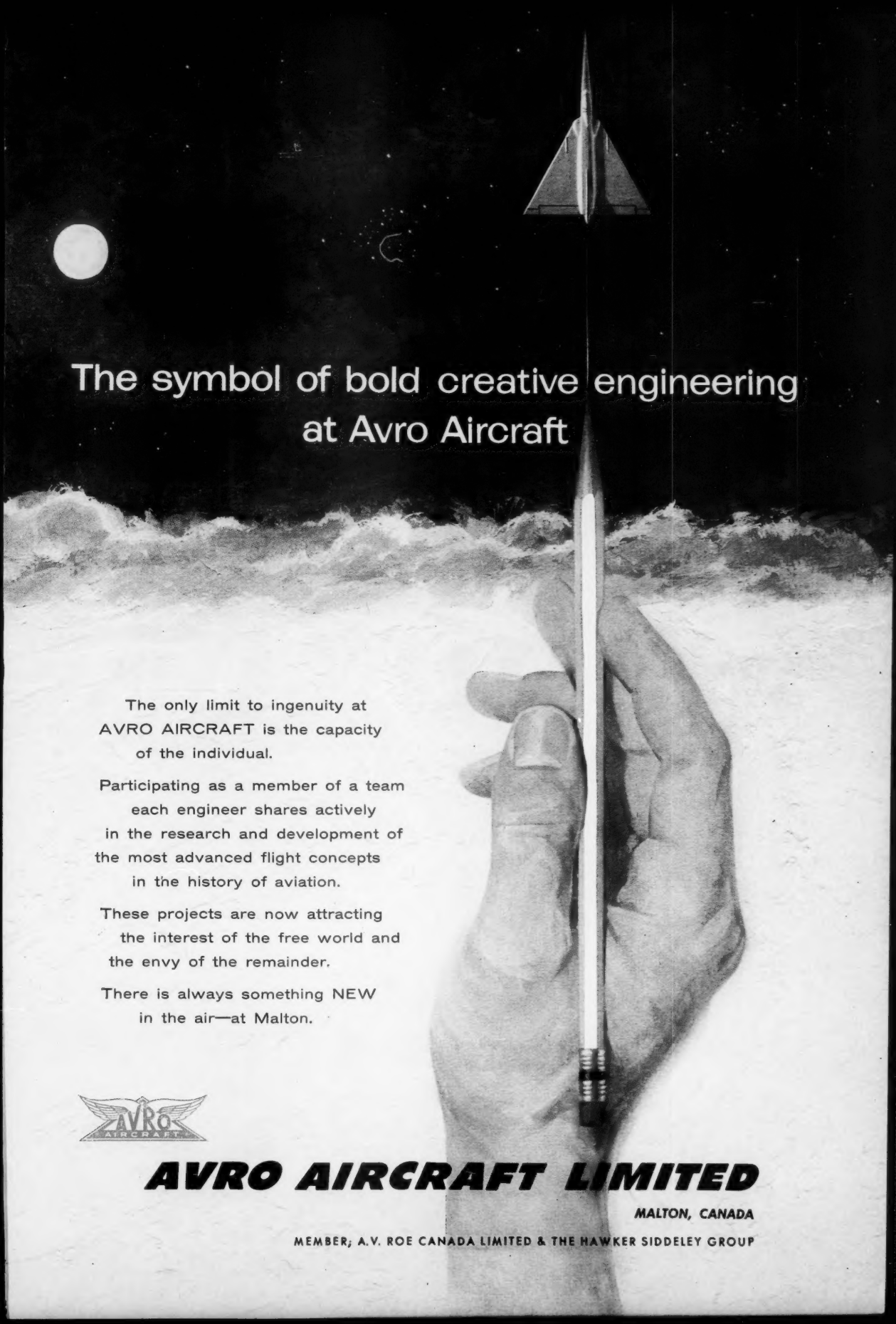

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Dynamic pressure pickup

A new type of pressure pickup is being introduced by **Consolidated Electrodynamics Corporation.** Known as Type 4-340, the device will measure dynamic pressures, which may consist of complex waves from sonic vibrations, blast pressures or water hammer in liquid-filled lines.

Dynamic pressure applied to the diaphragm of a sealed, liquid-filled cell causes an infinitesimal amount of polar liquid to flow through a porous disk, thereby generating an electrical signal. This electro-kinetic effect is known as the streaming-potential.

About 1 in. thick and of 1⅞ in. diameter, the pickup will operate at a pressure range of 10^{-4} to 100 psig and a temperature of —10 deg. F to + 140 deg. F. It will respond flat between 3 cps and 25,000 cps. Pressure oscillations in this frequency bracket will produce electrical signals that are in phase with the pressure and proportional in amplitude to it. This is extremely important, because it means that there is no phase lag or over-shoot of the pressure signals, as is common in periodic devices.

An outstanding feature of the pickup is its stability. After temperature cycles, pressure cycles, shock and vibration, it retains its calibration. Another major feature is its low internal impedance (100,000 ohms) which is much lower than that of piezo-electric devices now used in similar work. (216)

• • •

Nylon powder

A new formulation of finely divided nylon powders, Nylasint 64, has been developed by **National Polymer Products, Incorporated,** and supplied by its subsidiary, **Polypenco, Inc.**

The new powders are reported to be very much tougher in the cold pressed and sintered form than the sintered nylons heretofore available.

A prime use of Nylasint powders has been in the forming of mechanical components by cold pressing and oil sintering under the melting point, somewhat similar to techniques used in powder metallurgy.

Various inert fillers, such as molybdenum disulphide and graphite, provide specific property advantages.

The parts formed expand the field for nylon by providing higher wear resistance, lower surface friction and lower hygroscopic and thermal expansion. They have a high modulus of elasticity and less deformation under load. Another notable characteristic is the lower starting friction following the oil sintering process.

Halex Corporation, licensed fabricators of the parts, report that gears formed from the new impact resistance 64-MS (10% molybdenum disulphide) have been pressed to satisfactory tolerances and have prospects for use in a variety of gear applications.

The parts are economically mass produced, have uniform shrinkage and accurate profiles. Unlike injection molded parts, the parts do not require degating and contain no flash lines. At the same time, the possibilities of stress spots or internal strain are measurably reduced.

In addition to gears, the new formulation will be suitable for forming bearings, rollers, bushings, cams and similar wear parts. (217)

• • •

Brazing rings

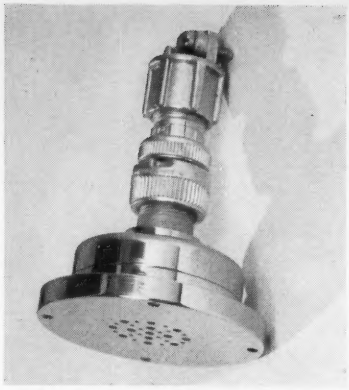
A new line of prefabricated Nicrobraz rings, for use with stainless steel tubular assemblies of all kinds, is now available from the Stainless Processing Division of **Wall Colmonoy Corporation.** Improved quality in the brazed joint, better finished appearance, elimination of waste and reduced assembly time up to 85% are among the advantages provided by the alloy in its new form.

Rings are available in alloy grades to suit any need and can be made for use with standard or special tube sizes or shapes for the aircraft, air conditioning, automotive, chemical, electrical and other industries.

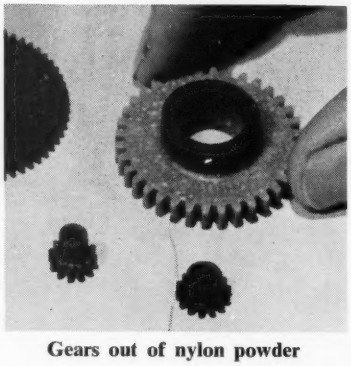
Produced accurately to individual specifications, dimensional tolerances in the ring are guaranteed within 0.001 in.

The new rings are designed to slip over the tube to be brazed thus simplifying and speeding fabrication operations. The dimensional accuracy provided in the rings assures application of an absolutely uniform thickness of brazing alloy at every joint. Such control eliminates material waste and scrap loss from brazing rejects. The result is a neat, attractive assembly with uniformly sound brazed joints and a good finished appearance. (218)

(Continued on page 68)

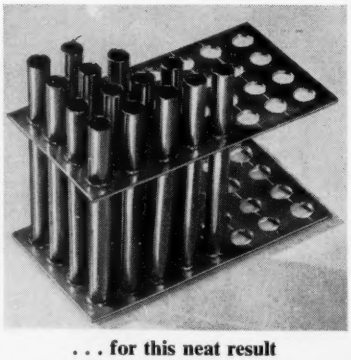


This will measure dynamic pressures



Gears out of nylon powder

The rings are added . . .



. . . for this neat result

What is a "Good" Casting?

"Good" is the measure of performance. A good casting measures up—in performance—to all the requirements of its buyer and its end user.

If, during its life, it must withstand repeated thermal shocks, then it must be heat resistant; if it is going to be subjected to constant friction, then it must be wear resistant; if it comes into contact with salts or acids, then it must be corrosion resistant.

"Very true," you say, "and also very obvious. It is one thing to make fine castings to fit the job but can you make the price fit the castings? That's a requirement, too."

We can. That's where our Special Products Plant comes in. It is run by experienced men, controlled by a first class laboratory and equipped with modern foundry equipment —it's an operation that's geared to meet quality *and* price requirements.

Our electric furnace, for example, allows flexibility, versatility and far greater uniformity of composition in the production of all types of iron.

The result: the best possible assurance against being let down half way through the machining operation. Your shop investment is thus protected.

So when *you* need "good" alloy castings, delivered clean and on time, order them from:

Canada Iron
foundries, limited

FOUNDRY & MACHINE DIVISION

HEAD OFFICE: 921 Sun Life Bldg., Montreal — TORONTO OFFICE: 171 Eastern Ave., Toronto

Literature is available on the following engineering irons and alloy irons produced by our Special Products Plant:

If you would like valuable information on any or all of these irons, tick them off and mail this coupon.

NODULOY ☐ NI-RESIST ☐
NI-HARD ☐ DOMITE ☐
NODULOY NI-RESIST ☐

Your Name _____

Address _____

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Servospeed
HEART OF AUTOMATION
MODERN ELECTRONIC ENGINEERING GIVES PRECISE MOTOR SPEED CONTROL
Modern industrial electronic engineering has been coordinated with electric motor design to provide a versatile means for obtaining the full possible advantage of speed control in DC motors while operated from the regular alternating current power line. Grid controlled "Thyratron" tubes are utilized for power controlled stepless variation to supply motor armature power. Patented feedback, or "Servo" circuits provide constant torque capability over wide speed ranges of as high as 60 to 1 in some models and a minimum of 20 to 1 in others.
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DIV. of ELECTRO DEVICES, Inc.
4 Godwin Ave., Paterson, N. J.
ARmory 4-8989

New products
continued

Control thyratron

A new control thyratron which will give manufacturers high standards of reliability and offer equipment designers three different base connections, is available from **Canadian General Electric Company's** Tube Section.

The tube will give improved performance, yet be less expensive than the GL-5545 which is now superseded. The three new types of this 6.4 amp negative control characteristic thyratron — GL-6807, GL-6808 and GL-6809 — all incorporate element and envelope construction designed to provide maximum cooling to eliminate major causes of inoperation, and resulting loss of factory time and possible damage to equipment.

The GL-6807 has a pin-type base and can be used interchangeable with the GL-5545. The GL-6808 has flexible flying leads whilst the GL-6809 is made with spade lug terminals extending from the base.

Because they carry high commutation factory ratings, they are particularly suited to motor control and other inductive load circuits without cushioning. Their ability to operate over a wide ambient temperature range (—55 to +70 deg. C) and a quick-heating cathode (1 minute) are features of particular usefulness in industrial applications.

New anode and grid structures feature relatively large external surfaces which permit cooling by convection as well as radiation. The lower operating temperature thus achieved safeguards against grid emission — one cause of inoperation. In turn, lower grid emission permits elimination of an internal baffle which in the past has brought about high starting voltage conditions, another cause of inoperation.

By brazing the anode cap directly to the anode lead and using a new basing cement, the mechanical problems usually related to loose anode caps and a loose cathode base have been virtually eliminated in the new tubes.

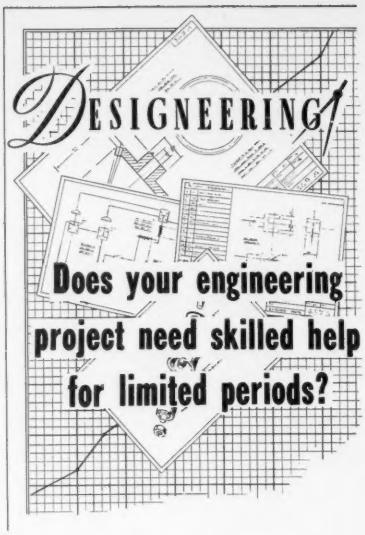
Maximum average cathode current of these motor control thyratrons is 6.4 amps and fault current 1,120 amps. Maximum negative control grid voltage before conduction is minus 250 volts and during conduction minus 10 volts. Maximum positive control grid current is 0.20 amps with the anode positive and 0.10 amps with the anode negative. (219)

• • •

Aluminum oxide coatings

A new material—aluminum oxide—to be flame-plated on parts subject to continu-

(Continued on page 70)



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- design . . . . • layout drafting
- detail drafting . . . . • tracing
- technical illustrating and writing

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- Mechanical
- Aeronautical
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- Jig and Tool

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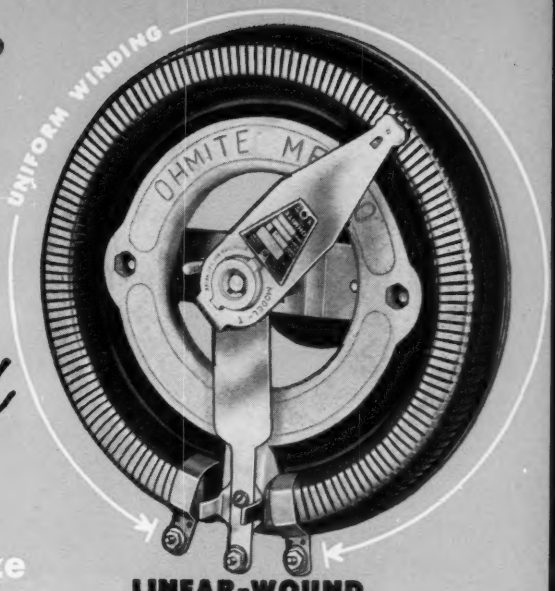
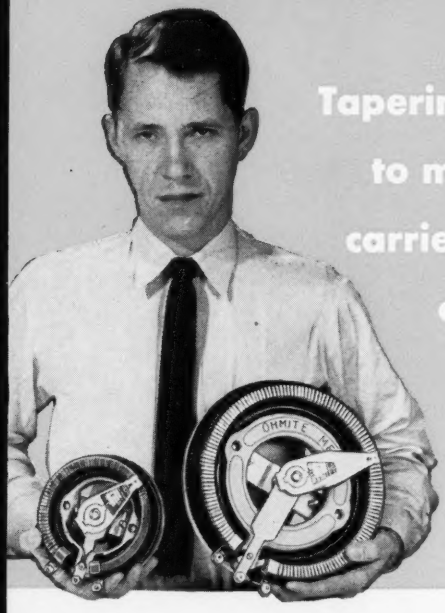
OHMITE®

taper-wound

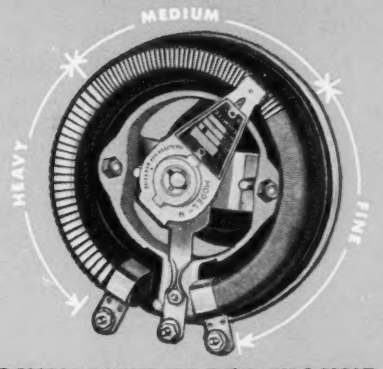
RHEOSTATS

reduce rheostat size required





Tapering the wire size to match the current carried permits greater capacity in a smaller unit!



A smaller rheostat may often be used for a given load by having the rheostat windings tapered or wound in two or more sections of diminishing wire sizes. This can be done because only the first turn of the winding carries the maximum current . . . succeeding turns carry reduced amounts. This makes possible great savings in control-panel space, making Ohmite taper-wound rheostats particularly useful in portable equipment. Ohmite taper-wound rheostats are also very durable because they use the largest wire sizes practical for the current to be carried.

MORE UNIFORM CONTROL—For a given application, the tapered winding also provides more uniform control. Because a linear-wound rheostat adds a constant number of ohms per degree of rotation to a constantly increasing number of ohms, the current changes more slowly as the resistance is increased. A tapered winding, by increasing the number of ohms per degree of rotation as the total ohms in circuit increases, makes the current curve more nearly linear.

Ohmite has an extensive line of standard tapered rheostats, or will design special tapered windings to suit individual needs.

Write on company letterhead for Catalog and Engineering Manual No. 40.

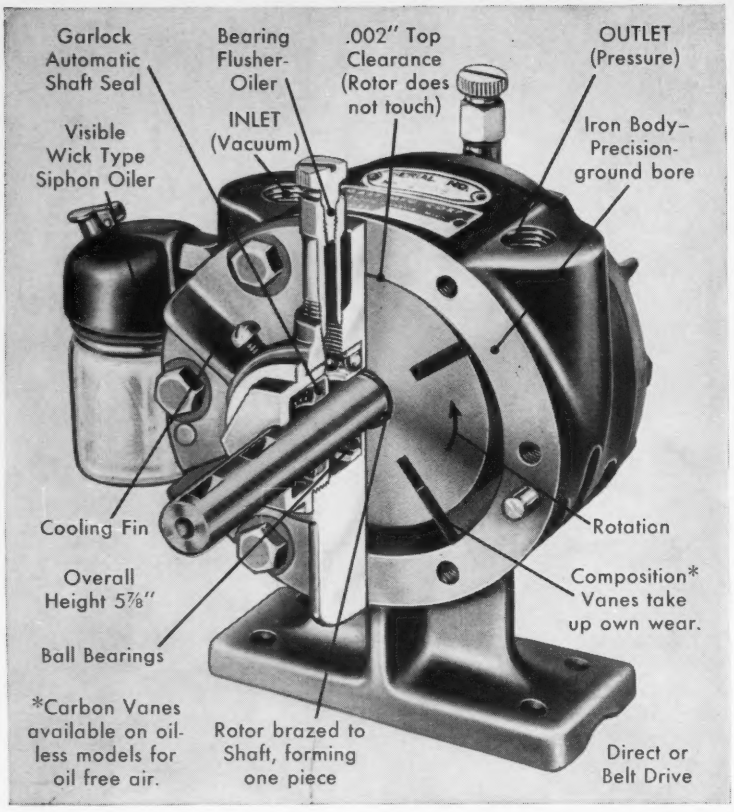
OHMITE MANUFACTURING COMPANY, 3674 Howard Street, Skokie, Illinois (Suburb of Chicago)

MORE OHMITE RHEOSTATS SOLD THAN ALL OTHER MAKES COMBINED

Be Right with

OHMITE®

RHEOSTATS • RESISTORS • RELAYS • TAP SWITCHES


Garlock Automatic Shaft Seal
Bearing Flusher-Oiler
.002" Top Clearance (Rotor does not touch)
OUTLET (Pressure)
INLET (Vacuum)
Visible Wick Type Siphon Oiler
Iron Body–Precision-ground bore
Cooling Fin
Rotation
Overall Height 5⅞"
Composition* Vanes take up own wear.
Ball Bearings
*Carbon Vanes available on oil-less models for oil free air.
Rotor brazed to Shaft, forming one piece
Direct or Belt Drive

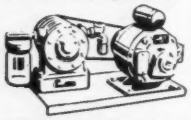
rotary vane

Quality and simplicity keep

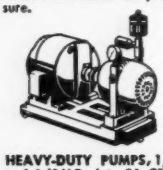
GAST AIR PUMPS

operating for years at high efficiency levels

INTEGRAL-MOTOR PUMPS 1/12 to 1/3 H.P. .6 to 4 CFM. to 28" VAC., to 25 PSI.



LIGHT-DUTY PUMPS, V-belt or direct drive. 2 to 24 CFM. Moderate vacuum or pressure.



HEAVY-DUTY PUMPS, 1/4 to 1-1/2 H.P. 4 to 21 CFM. To 28" VAC. or 30 PSI. Cooling fans and fins.

As original components—or for special plant use—Gast Air Pumps offer important advantages. This cutaway reveals many reasons why they are specified as "original equipment" by more and more leading manufacturers.

All models are built to high quality-precision standards in a new, modern plant. All embody this inherently efficient, simple rotary-vane design. Balanced rotor is free of vibration. Sliding vanes are light in weight—for minimum motion-energy-friction loss compared to other pump designs. As vanes take up their own wear automatically, pump delivers full performance through years of use.

Get full details—write for "*Application Ideas*" *Booklet and Catalog.* Many sizes—*mention capacity and type that interests you!* GAST MFG. CORP. in Canada Griswold & Co. Ltd., 146-D Bates Road, Montreal 8, Quebec.

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY

- AIR MOTORS TO 4 H.P.
- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 28 IN.

SEE OUR CATALOG IN SWEET'S PRODUCT DESIGN FILE

New products

Continued

ous wear, has just been introduced by **Linde Air Products.** The flame-plating process, which is also used to apply tungsten carbide coatings (see Design Engineering, June 1956, page 44), has had excellent results in many areas of industry. The new aluminum oxide coating will be useful on parts where resistance to erosion and corrosion at high-temperatures is necessary, in addition to a prolonged wear life.

The 99% gamma aluminum oxide coating has a hardness of 1,000 to 1,200 VPN (300 gm load) and less than 1% porosity. It can be applied, in thicknesses from 0.001 to 0.040 in., on to all common engineering metals. Deposition on ceramics and glass is also possible.

Common acid and salt solutions, oxidizing and reducing atmospheres and many low temperature molten metals do not affect the coating. In fact, it does not begin to deteriorate below 1,200 deg. F, and in some cases, not below 1,800 deg. F. The actual temperature at which coating break-up occurs depends upon the base metal. Aluminum oxide, like flame-plated tungsten carbide, can be left at the as-coated roughness (125 to 150 microinches rms) or finished to 1 microinch rms.

Some suggested uses for aluminum oxide coatings are: seals operating under heat and in corrosive media, thrust bearings, pump plungers, aircraft engine parts, guided missile components, heat-resistant surfaces for electronic components and all areas where resistance to temperature and wear is required. (220)

• • •

Compression conveyor

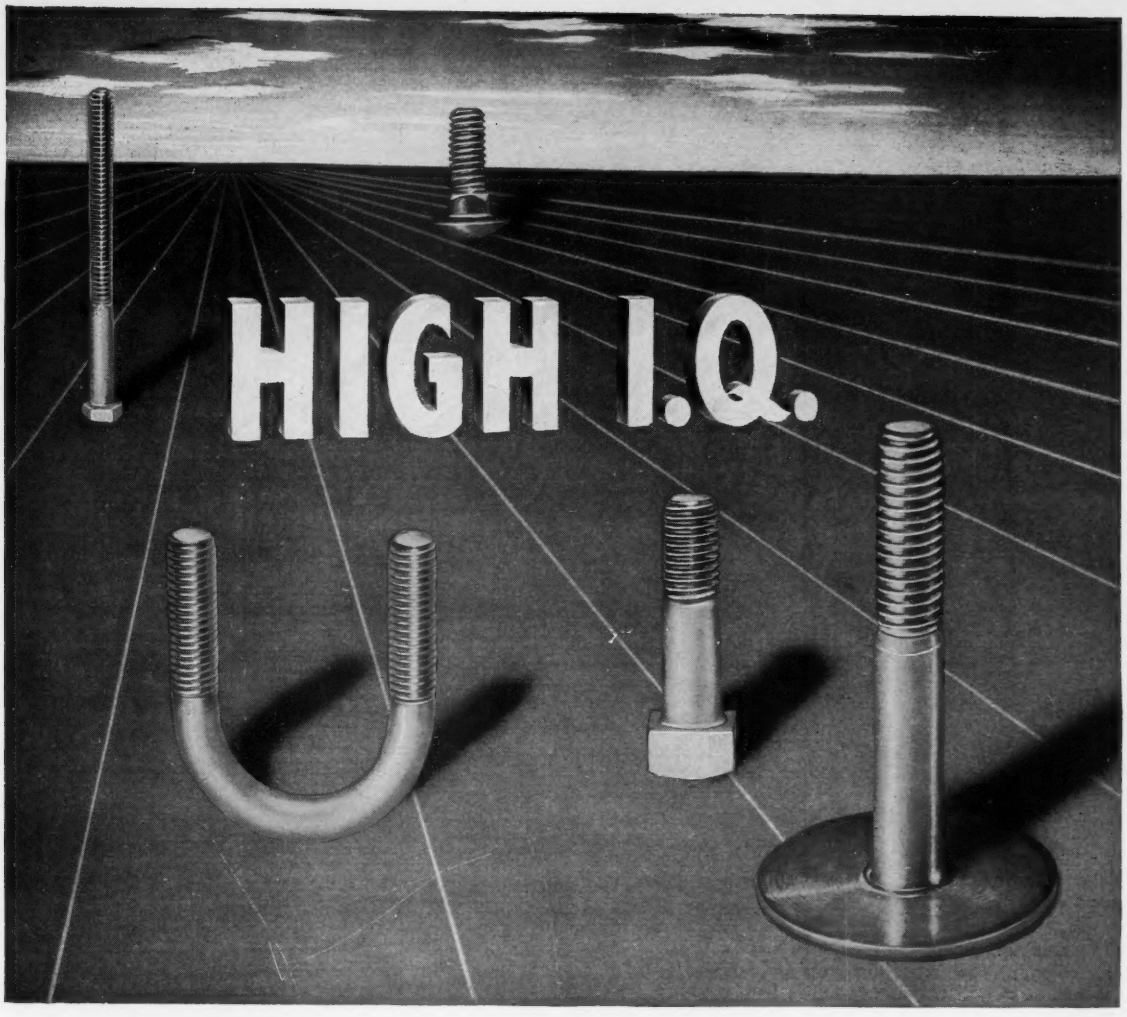
A new conveyor for compressing flaps of cartons until the glue sets is announced by **Specialty Manufacturing and Distributing Co. Ltd.** This conveyor is suitable where the packing operation is not large enough to warrant the purchase of an expensive carton gluing machine. The operator simply applies the adhesive to the carton flaps, choses them and feeds the carton into the conveyor. The side compression belts, which are adjustable, hold the flaps tightly in place. By the time the carton reaches the delivery end, the flaps are securely sealed. (221)

• • •

Double-acting cylinders

A new series of double-acting cylinders, with an elliptical non-rotating piston rod, is now available in 1¾ in. and 2½ in. bores. The new design is intended for applications requiring an accurate register

(Continued on page 83)



Save production steps with Noranda HIGH I. Q. Silicon Bronze

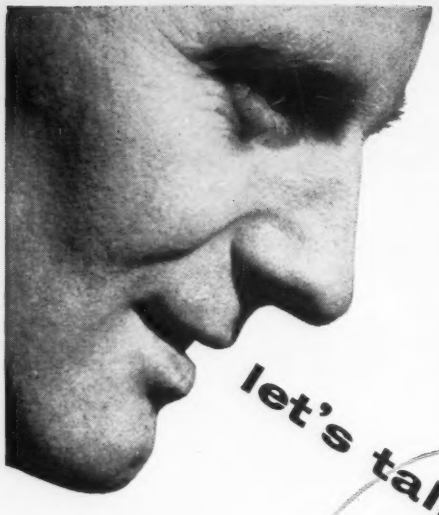
Products of this high-strength, ductile alloy are resistant to stress-corrosion cracking . . . need no additional heat treatment.

Fine ductility and other *High Inner Qualities* of Noranda Silicon Bronze (Alloy 609) make it the logical choice for all types of cold-upset and roll-threaded screw products. Its finished tensile strength of about 90,000 psi assures rugged service under extreme conditions. Its superior corrosion resistance makes it ideal for outdoor applications.

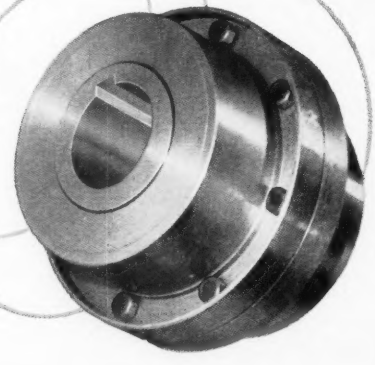
Your nearest Noranda Sales Office will be glad to show you how Silicon Bronze and other Noranda *High I.Q.* alloys can add speed to your production, quality to your products, profit to your sales.

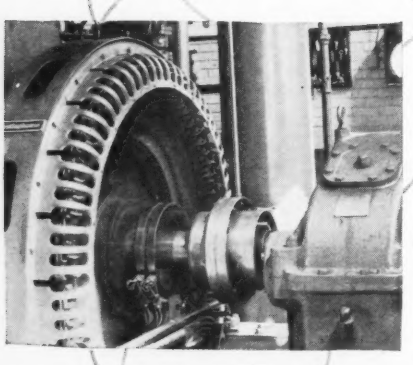
Noranda Copper and Brass Limited

SALES OFFICES: MONTREAL • TORONTO • WINDSOR • EDMONTON • VANCOUVER



let's talk couplings





...and specifically Dominion Gearflex Couplings

Men of experience install Dominion Gearflex Couplings as the most dependable link between power and production—to connect motors and machines. They have been proven in service under the heaviest conditions of shock loading and in all types of applications. They are simple to install... protect connected machines from damage. Are of all-steel construction—with positive, oil bath lubrication ... having no pins, bushings, plates or springs to replace—they're *always available*... for high *or* low speed applications up to 18″ and from stock for shaft diameters up to 10¾″.

Write for Bulletin No. B-364-49A to Dominion Engineering Company Limited, Industrial Division, in Montreal, Toronto or Vancouver.

DOMINION ENGINEERING
COMPANY LIMITED

This is a new model
(causing some anxiety)

with a few bugs
(holding up production)

which could be ironed out
(through top-quality components)

by a dependable source of castings
(from Wallaceburg, certainly)

Production problems can often be solved by a reliable source of top-quality component parts—which means Wallaceburg. For fifty years, Wallaceburg has been supplying industry with high-grade components—at the right time, and at the right price.

With Wallaceburg-Singer Limited producing Cored Brass Forgings, we've more than ever to offer. Call in the man from Wallaceburg for Die-Castings in zinc and aluminum, Machined Sand Castings in brass and bronze, Automatic Screw Machine Products in brass, steel and aluminum, and Cored Brass Forgings. **And because we have all these processes, we'll honestly and intelligently tell you which is right for your component.**

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BRASS LIMITED
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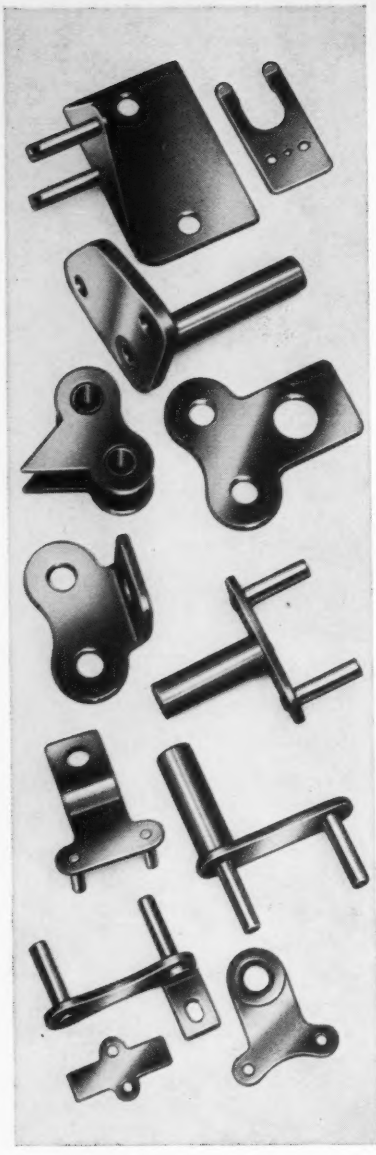
AND AFFILIATED COMPANIES
WALLACEBURG-SINGER LIMITED
DOMINION DIE CASTING LIMITED

BRANCHES: MONTREAL, TORONTO, MONCTON, LONDON, WINNIPEG, CALGARY, VANCOUVER



Acme
SPECIAL
ATTACHMENTS
provide great
versatility
for
CONVEYOR
CHAINS

Acme Precision conveyor chains are easily adapted to special requirements by the use of stock or specially designed attachments. Possibilities for modification of Acme standard chains are practically endless. In all adaptations, Acme engineers are skilled in retaining as many standard parts as possible to reduce costs.

Most attachments are in reality special plates which take the place of standard chain plate and are stamped from dies in production quantities. Attachments in smaller lots can be hand machined, cast, bent or welded to your specifications.

Whether you use a simple extended pin design or more elaborate attachments used for timing and motioning special conveyor lines, Acme engineers are ready to design practical applications for you.

All Acme conveyor attachments available in stainless steel for the packaging and food industries. Write our engineering department.

FREE CHAIN CATALOG

Write Dept. 20-A for your 80-page copy of Acme's latest catalog. Packed with valuable chain data. An indispensable chain reference.

Call ACME for Service

Acme Chain Corporation
HOLYOKE
MASSACHUSETTS

Hydraulic packings

(Continued from page 40)

sult the packing manufacturer for a more suitable packing material or design.

(3) **Blow Out of Cup or Hat Packing**

The causes of this condition may be inadequate compression of the packing flanges; the use of a material too elastic to withstand the pressure encountered; softening of the material caused by heat or the swelling action of the fluid. Possibly fabric or cloth-inserted packing in place of pure packing will remedy this trouble. The compression should be limited by the provision of shoulders, space collars and so on. In some cases the cup and hat packings can be improved by the use of narrow annular rims provided either on the flanges, the packing or on the contacting metal parts.

(4) **Excessive Friction**

Excessive friction is the result of heel extrusion; the use of an unsuitable packing design; distortion of the packing due to swelling; too much flange compression and tapping of packing after blow out. Heel extrusion, blow-out and overcompression can be prevented in ways already explained. If due to design or swelling, consult the packing manufacturer.

(5) **Binding or Judder**

When the piston tends to bind or move jerkily, the cause is usually due to a wedging or jamming effect associated with certain designs of seal when used with fluids with poor lubricating qualities. This condition can usually be eliminated or reduced by stiffening the seal section, reducing the lip height and lip conicity. In other words, by using a seal with a heavier or stubbier lip.

(6) **Hardening of Material**

This condition is caused by heat, which reduces piston clearance, or by using unsuitable material.

Remedy it by reducing piston clearance, if the design permits, and if this does not lead to a complete cure, consult the packing manufacturer for a more suitable material or design.

(7) **Types of O Ring Failure**

Two types of O ring failure have been reported from various sources after short periods of operation when used as rod seals. These are extrusion nibbling and spiraling.

Extrusion nibbling, believed to be the result of clearance changes at one or more positions of the ring, was fairly common when O ring packing was first introduced. Failures can be corrected by installing leather back-up rings on one side of the seal. Recent experience with non-flammable fluid installations requiring the use of butylpolymer seals has resulted in the development of Teflon back-up rings. These are generally superior to leather rings both when used in mineral oils and non-inflammable fluids. ★

This potentiometer
has no slidewire
In DYNALOG Instruments, a simple, radio-type variable capacitor replaces the troublesome slidewire — gives unmatched smoothness of balancing.

STEPLESS CAPACITY-BALANCING
ELIMINATES STANDARDIZING!

DYNALOG'S EXCLUSIVE BALANCING ACTION

- no slidewire
- no batteries
- no standardizing
- no gears, cables, etc.
- no high-speed reversing motor

Here's the potentiometer that's *never* "off process" for standardizing. It requires none! The Dynalog's advanced, stepless-balancing design eliminates dry cell, provides *direct, uninterrupted* evaluation of the measured variable with sustained high accuracy.

Dynalog design eliminates slidewire maintenance and motor servicing too! A simple, variable capacitor and positive magnetic drive provide smooth, continuous balancing action . . . instant response without wear. There are no fast-moving parts . . . no gears, cables, or complicated mechanisms. Only five moving parts, including the recording pen!

Dynalog Instruments are available for use with resistance, voltage, capacity, or inductive type primary elements to measure and/or control any process variable. For complete details, write for Bulletin 427-1. PEACOCK BROTHERS LIMITED, P. O. Box 1040, Montreal 3, Quebec.

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DYNALOG
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This is the 3-dimensional dial of the new Westclox model, "Snowflake" . . . precision moulded by Smith & Stone.

The right kind of moulding does much to increase the sales appeal of plastic products. And the right production method can do a great deal to reduce costs. If you are considering the use of plastics, investigate the services we offer. They include facilities for engineering, development, tooling, manufacturing and assembly.

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IRE Show

(Continued from page 46)

the requirements of the armed forces. This valuable customer was represented at the exposition by a combined services booth emphasizing the co-operation of our three services.

Lt. D. S. Lochead, RCN and Mr. R. G. Bullock, Inspection Services, were on duty at the booth when I stopped by. They briefly explained their function in relation to Canadian manufacturers and stressed the fact that one of their primary objectives is to improve the reliability of electronic equipment for the forces.

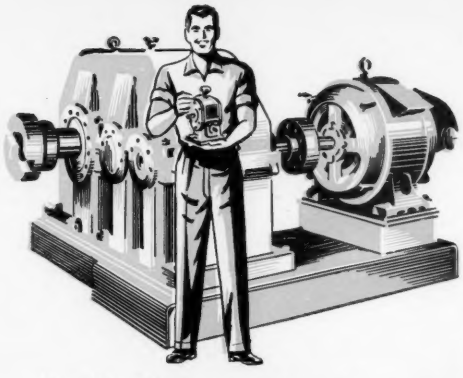
At another booth farther down the aisle the Department of National Defense, Defense Research Board, displayed some of their unclassified projects. One field of work has been the study of high speed aerodynamics. Photographs and models illustrated their facilities at Valcartier for projecting and photographing the scale models used to test the aerodynamic properties of various wing designs. These models are later tested in free flight over Lake Ontario.

The xerographic process which owes its existence to electronics, has finally been able to make a contribution to its parent. Until recently this process, developed by the Haloid Company, has been used primarily by the printing industry. Now, however, a method has been developed for producing printed circuits with Xerox equipment. The first demonstration in Canada was carried out at the Haloid booth. Basically, the process consists of placing the blank plate in the back of the camera after first being electrostatically charged. The image of the circuit passing through the camera lens and falling on the charged blank causes the charge to leak off where white areas exist on the original. The exposed blank is then treated in much the same fashion as in the photographic method to obtain the final etched circuit. Speed and low cost, as well as versatility, are the prime features likely to bring this process more and more into the news within the next few months.

Another industry that owes much of its very existence to the atomic age was exemplified by the Radelin-Kirk Limited display. This is the production of radio-isotope-containing sealed sources, isotope-activated light sources and luminous compounds. The television industry, aviation and radar industries are the principal users of these products. Radelin-Kirk displayed a number of luminous dials including their latest design wherein the scale was constructed of non-luminous markings with a solid luminous area backing it. This technique is claimed to produce scales much easier to read than those having luminous markings on a blank field. Another product being de-

(Continued on page 79)

Gears



Rugged, quiet in operation and designed for extremely long service, Hamilton Gear Speed Reducers are favoured in a wide range of industrial and mining operations. Helical gear speed reducers—like the unit pictured above—have replaced herring-bone reducers in most applications because single helical gears require no centering and take the load evenly over the whole gear face despite any external thrust. These units can be equipped with a back-stop to prevent reverse rotation—for instance when used with an inclined conveyor or bucket elevator. These versatile Hamilton Gear reducers come in ratios from 2 to 1 up to 800 to 1, in single, double or triple reduction.

For further information write for Catalogue No. 113.

Hamilton Gear standard speed reducers are made in sizes ranging from units small enough to be carried easily by one man up to reducers weighing 18 tons.

In all sizes for every industrial application—

Hamilton Gear and Machine Co., Limited.

HG-T-3-55

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Flexible Couplings

Racks

Helical Gear Reducers

Helical Gears

Spur Gears

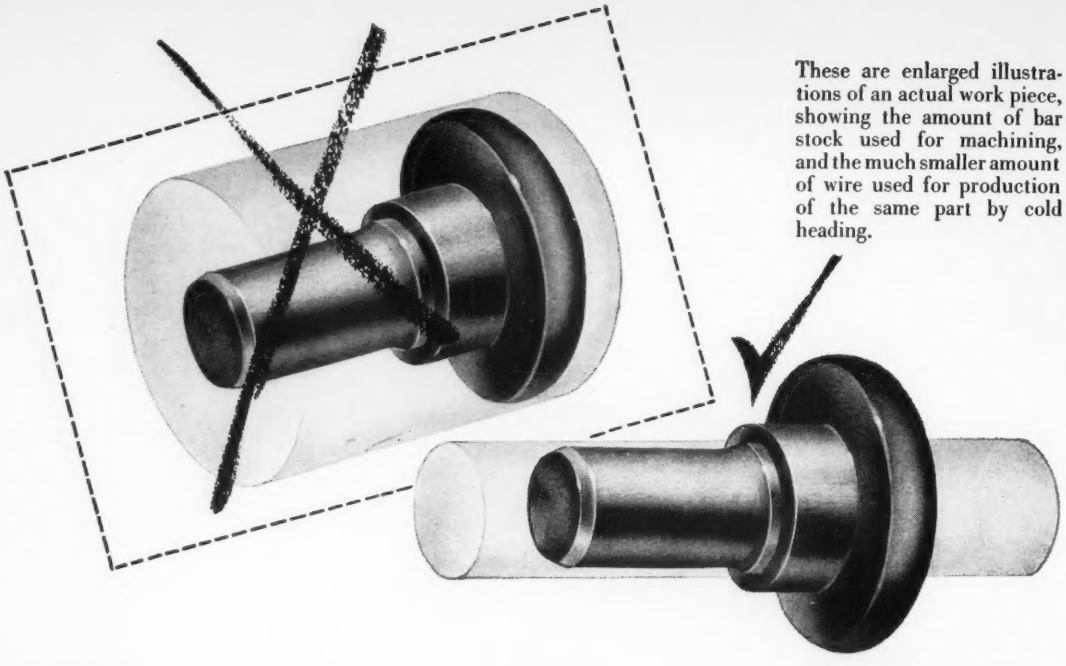
Bevel Gears

Herringbone Gears

Worms and Wormgears

Internal Gears

Wormgear Reducers



These are enlarged illustrations of an actual work piece, showing the amount of bar stock used for machining, and the much smaller amount of wire used for production of the same part by cold heading.

Why pay for metal you can't use?

Compared with other production methods for parts involving contours and special shapes, cold heading offers faster output, lower unit costs, and a high degree of uniformity in quality and dimensions.

On Stelco's modern Cold Heading equipment, wire up to 1″ in diameter, of any forgeable metal, can be upset to 4½ times its original diameter with virtually no scrap . . . effecting a self-evident saving in material over methods involving the machining down of heavy bar stock. Secondary operations — such as threading, punching, bending, or shaving — can be added economically if desired.

The possibilities of economy and product improvement offered by Stelco's Cold Heading technique are relatively new. Why not investigate their application to *your* operations? Any Stelco Sales Office will co-operate promptly.

STELCO **COLD HEADING**

can save up to 67%
on the metal alone,
for contoured parts

56141.B

THE STEEL COMPANY OF CANADA, LIMITED

Executive Offices: Hamilton — Montreal

Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Winnipeg, Edmonton, Vancouver.
J. C. Pratt & Co. Limited, St. John's, Newfoundland.

IRE Show

(Continued from page 76)

veloped is the self-contained light source constructed from such materials as krypton 85, strontium 90 and tritium. A possible use for these light sources would be to replace the lanterns now used on railway switch signals.

Too often we think of electronics in terms of communication sets or radar, and forget that this industry plays an important function in our everyday lives under the category of industrial electronics. Mr. Corby, chief design engineer of Industrial Electronics of Canada Limited, demonstrated their latest version of the Dynalite, a photo-electric control for street, highway and area lighting. Visitors may recall the storm and very heavy overcast we had on Tuesday morning, the second day of the convention.

If on the way home, you had to battle with the Toronto rush hour traffic you would undoubtedly advocate immediate installation of the Northern Electric Company Limited radar vehicle detector and traffic control system. This equipment is capable of sensing traffic movement and adjusting the traffic lights for optimum movement of the traffic. At the moment it is being tested. ★

Answers to KWIZ KORNER

1. **Parallelepiped.** This is the solid figure bounded by six plane surfaces, with opposite pairs of faces similar and parallel.

2(a). **Tungum.** A particular brass alloy containing small amounts of aluminum, nickel and silicon. It has non-magnetic and non-corrosive properties and a high strength-to-weight ratio. Usually in tube form.

2(b). **Tungsten.** This metal is obtained from wolfram. A common application is in the form of tungsten carbide for the tips of high-speed cutting tools. It lends itself well to this application because of its great hardness.

2(c). **Tung Oil** is obtained from the tung tree and is also known as China wood oil. It is quick-drying and has waterproof qualities, as a result of which it is used in the manufacture of oil paint.

3(a). **Solenoid.** A solenoid consists of a coil of wire containing a number of turns wound round a hollow cylindrical former through which passes an electric current. Due to its electro-magnetic properties, it will attract an iron plunger moving inside the former.

3(b). **Solidus.** In an equilibrium diagram, the solidus is the line showing the solidifying temperatures of a range of alloys of varying composition.

NOW ...The Aerosol Lubricator

MACHINE TOOL DESIGNERS

Have been asking for

Norgren

MICRO-FOG® 33AG-4

COMPACT
This new unit measures 6-1/32" x 5-3/16" x 6-1/32".

COMPLETE
Includes an Air Line Filter, a relieving type Air Pressure Regulator, and a MICRO-FOG Lubricator with a large, ⅝ pint oil capacity.

ATTRACTIVE
Blends in with smooth flowing design lines . . adds to the appearance of a machine tool.

EASY TO INSTALL
Offers in-line pipe connections—optional locations of air inlet and filter drain. Has two outlets for filtered air —one for MICRO-FOG.

Model 33AG-4 Lubro-Control Unit

- Filter
- Regulator
- Lubricator

EASY TO MAINTAIN
No tools needed to reach filter element or to refill oil reservoir. Back cover is removable.

CANADIAN REPRESENTATIVES

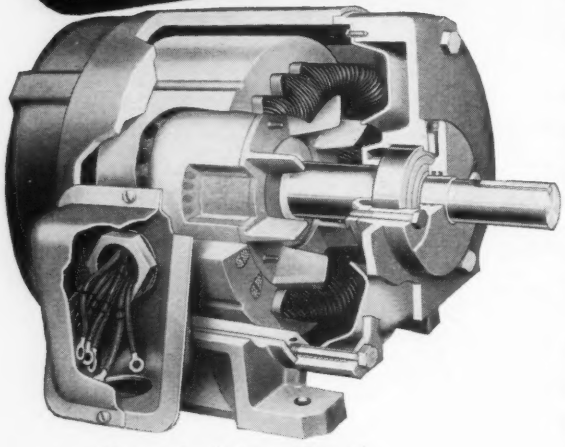
Cowper Company, Ltd., Montreal 32
Galbraith & Sulley, Ltd., Vancouver 9
John Spotton Co. Ltd., Toronto 14

MICRO-FOG® by G.A. Norgren CO.

3445 SO. ELATI ST., ENGLEWOOD, COLORADO

Let Allis-Chalmers help you meet your exact motor needs!

ALLIS-CHALMERS MOTORS



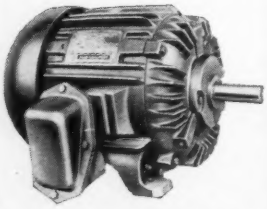
Cross-sectional view of Type G, 1½ hp., open Drip-Proof motor.

No matter what your motor problem, Allis-Chalmers can help you solve it quickly, easily.

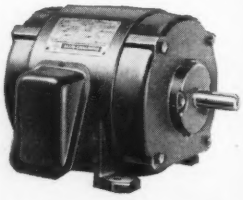
Backed by half a century of electrical manufacturing experience, Allis-Chalmers offers a complete line of polyphase induction motors designed and built for long life, minimum maintenance, maximum reliability.

Available with many special modifications to suit specific requirements, types include Drip-Proof, Splash-Proof, Explosion-Proof, Totally Enclosed Fan-Cooled, in vertical mounting, flange mounting and multi-speed construction. Ratings up to 300 hp.

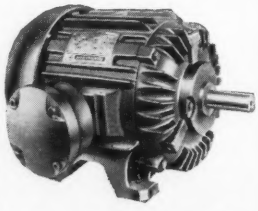
For further information, contact your nearest CA-C Sales Office, or write direct to Canadian Allis-Chalmers Ltd., St. Thomas, Ont.



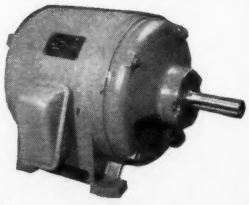
Type GZ, 5 hp., Totally-Enclosed Fan-Cooled standard motor.



Type G, 1½ hp., open Drip-Proof type motor.



Type GZZ, 5 hp., Totally-Enclosed Fan-Cooled, explosion-proof motor.



Type AP, 15 hp., open Drip-Proof motor.

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CANADIAN ALLIS-CHALMERS

56-M-1R

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of the piston rod without cumbersome external guides.

The new cylinder, known as Model E, is a development of the **Alkon Products Corporation** Model D double-acting cylinder, and has all the construction features of that model, including 3-way flush rabbet mounts as standard equipment. The radical rod configuration is based on experience with the widely used single-acting cylinder with non-rotating rod, and is designed to fill the need for the non-rotating feature in a double-acting cylinder, where heavier return thrust is desired.

It has an elliptical bushing, adjustable to permit compliance with different rod fit requirements, as well as compensate for eventual wear. (222)

• • •

Fuse resistor

A completely insulated Type FR fuse resistor, which functions as a resistor under normal conditions and as a fuse under abnormal conditions, is announced by **International Resistance Company.** This unit supplies the need for a small, compact, fully-insulated resistor-fuse combination that can be easily plugged into a receptacle. Its construction gives mechanical strength and simplicity to the complete unit. It also prevents overloading of more valuable components and possible fire due to short circuit in TV sets and is particularly recommended as a surge-limiting resistor in voltage double circuits for TV receivers. (223)

• • •

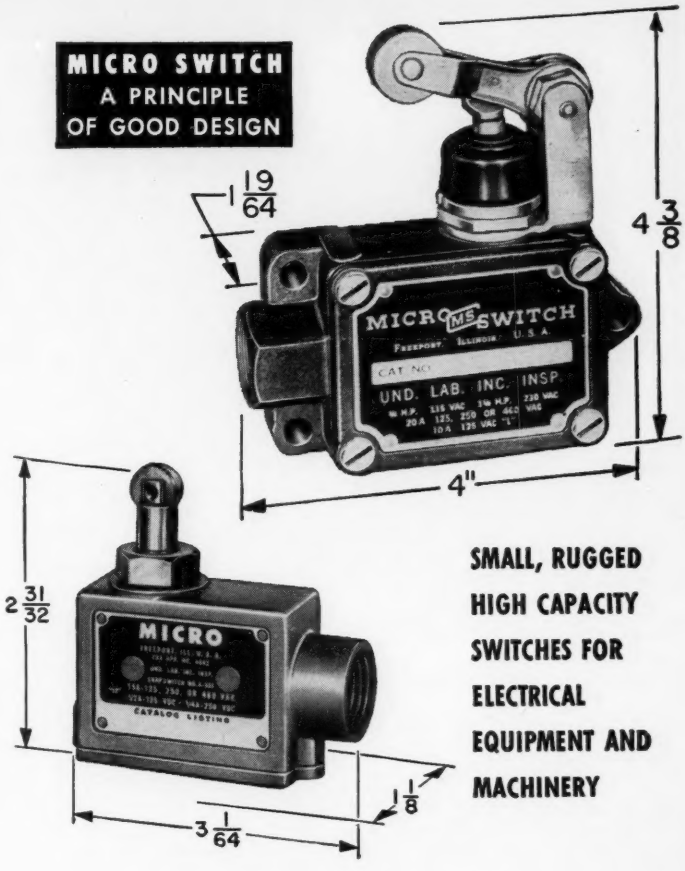
Turnbuckle

A turnbuckle of completely new design has just been announced by the **Pheoll Manufacturing Co. (Aviation Division).**

The Cabuckle, as it is called, averages about the length of an ordinary turnbuckle of similar capacity and is about 40% the weight. Made of anodized aluminum and molybdenum steel, tests have shown that this product will outlast three new high-fatigue cables. Installation is claimed to be easier because the unit never changes length and the amount of takeup remaining is visible at a glance. Pre-drill holes for short safety wiring are provided. These features also permit use in restricted areas.

Operation is simple. Balls are swaged on cable ends and one cable end remains stationary while the other end seats on a crosspiece that is adjusted by a nut on the threaded exterior. (224) ★

MICRO SWITCH PRECISION SWITCHES



SMALL, RUGGED HIGH CAPACITY SWITCHES FOR ELECTRICAL EQUIPMENT AND MACHINERY

These MICRO SWITCH precision switches are enclosed in a sturdy aluminum housing that protects the mechanism from damage, and makes mounting easy. They are available in a wide variety of sizes and shapes in side or bottom mounting designs with varying electrical characteristics and a selection of actuators.

Enclosed Basic Switch. Easily replaced in the field simply by removing the bottom plate. Model shown is a single-pole double-throw switch for use with cams whose approach is parallel to the axis of the switch. Others for cams with perpendicular approach.

High Capacity Enclosed Switch. For applications requiring a small enclosed switch which will handle a large electrical load. Single-pole, double-throw switch shown has actuator adjustable horizontally through 360 degrees and vertically through 225 degrees. Sealed against dust, dirt and oil splash.

MICRO SWITCH produces a complete line of reliable, small-size switches for electrical equipment and machinery. As a vital part of every type of electrically operated equipment they will help make operation safer, more automatic and more productive.

For complete information write Honeywell, Dept. ENE-EE-6, Leaside, Toronto 17.

MICRO SWITCH

A DIVISION OF HONEYWELL REGULATOR COMPANY LTD.

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Serving people every day...

Stan Steel Tubing

At the playground...or right in your own rumpus room. In hundreds of places... and hundreds of ways. Wherever the emphasis is on modern living...that's where people are served by products made from Stan Steel tubing.

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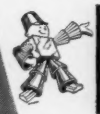


STAN STEEL
WELDED TUBING

Seamless Tubing · Fabrications · Aluminum

A micrometer where the skill is "built in"

The human error factors in sight and touch are absent in this micrometer

The final source of human error in precision measurements — the mental interpretation of a dial or scale position into the digits of a decimal dimension — now seems to be eliminated by using the new Model HDR Carson-Dice digital read-out electronic micrometer.

The exact dimension of a part can now be determined without influence from the three human variables inherent in the use of ordinary micrometers. This is because:

(1) Elimination of the human sense of touch in setting the instrument is done by an electronic circuit which responds instantly to contact between the micrometer anvil and the work before any pressure is built up on the work by the micrometer screw.

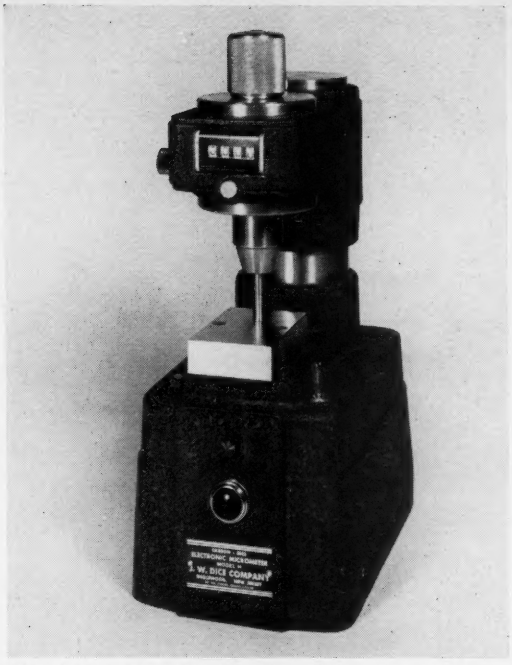
(2) Inexact or uncertain use of muscular power in positioning the work, or rotating the micrometer dials, is replaced by a motor drive which automatically brings the micrometer precisely to the point of contact much faster than is possible manually.

(3) Intellectual effort (and the possibility of error) is eliminated in interpreting the relative position of a zero line and a calibrated scale into a decimal dimension. The digital read-out counter on the front of the instrument displays the exact reading in ten-thousandths of an inch. Five divisions between each digit on the unit wheel permit readings to 20 millionths of an inch.

The instrument, like all its predecessors made by Carson-Dice, is a true direct reading instrument, not to be confused with a comparator. The screw thread micrometer as a direct measuring instrument has long been recognized for its important advantages of high magnification, minimum of moving parts and sturdy structure. It has been limited by the human variables in handling.

With this new counter type, direct reading automatic instrument, unskilled operators can make measurements with laboratory accuracy and precision, with a speed far beyond the best performance of a highly skilled operator with an ordinary micrometer, and with no pressure on the work. The reading is always the same no matter who pushes the button. Thus the advent of the first digital read-out or counter type automatic micrometer has done much to make fool-proof the very precise measurements required by industry today.

Model HDR has a measuring range of 1 in. (⅞ in. with standard micrometer tip) and a throat depth of 2 in. The upper head is adjustable in height to accom-



The Carson-Dice direct reading electronic micrometer.

modate work up to 2 in. A standard anvil is readily removed for the use of special fixtures. Repeatability is 0.00002 in.

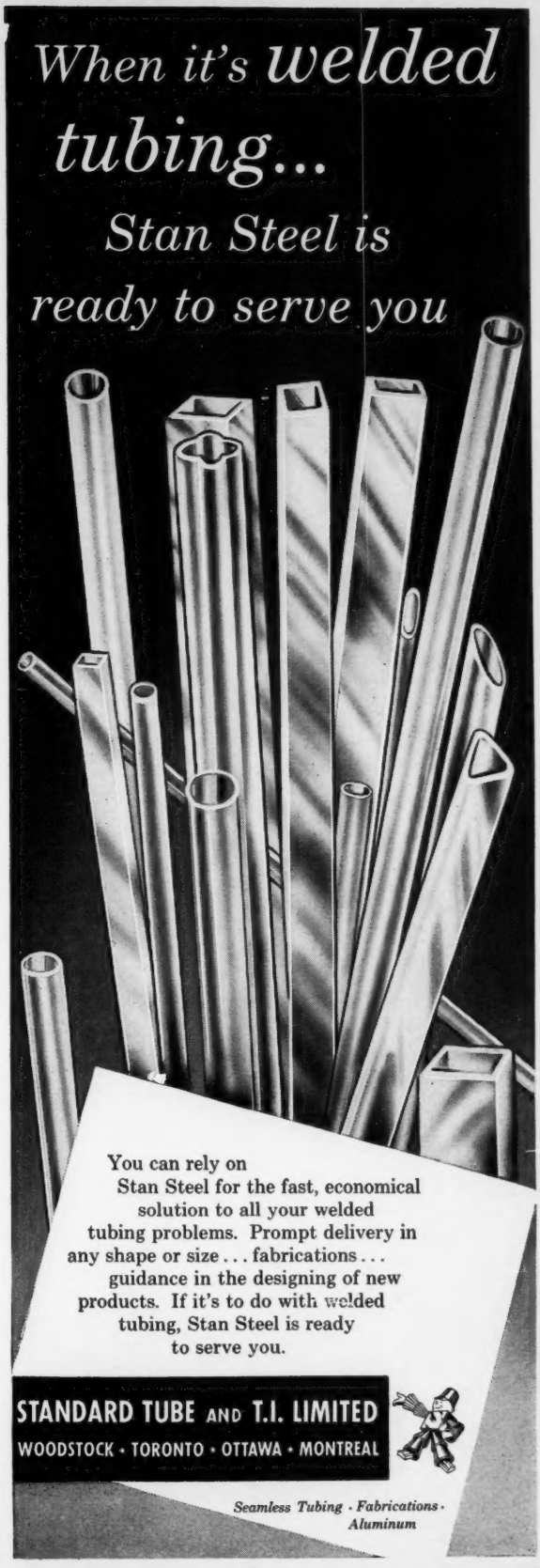
The operating cycle is much faster than the best speed possible with manual operation. The micrometer spindle is driven up by pushing the lever switch to the rear. After work is placed on the anvil, the lever switch is pushed forward and held until the measurement is completed, as indicated by a small green light under the counter. Upon release of the lever switch, the micrometer spindle automatically backs off to permit removal of the work. If oversize work is presented to the instrument and it touches the micrometer spindle, the control system automatically drives the micrometer up until the work is cleared.

An optional foot switch which plugs into a socket on the rear of the base can be used instead of the lever switch to leave both hands entirely free for handling work.

The electronic unit and motor control are self-contained within the base; a line switch fuse and sockets for grounded attachment cord and optional foot switch are at the rear of the base. The motor drive for the micrometer spindle is housed within the column, whilst the operating knob at the top of the instrument permits rapid shifting of zero to any position within the 1-in. range in setting up the instrument. A small knob on the side of the upper head facilitates setting the counter to zero.

The instrument is 11 in. high, 9 in. deep and 5½ in. wide and the power required is 18 watts at 115 volts a-c. Automatic control is incorporated in a single chassis accessible by removing a base cover plate. All connections to the chassis are plug-in and all indicator lamps are replaceable from the front of the instrument.

This electronic micrometer combines the speed of a dial indicator or comparator with complete freedom from contact pressure. Digital read-out eliminates any guesswork or interpretation of readings. ★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Stan Steel is ready to serve you
You can rely on Stan Steel for the fast, economical solution to all your welded tubing problems. Prompt delivery in any shape or size... fabrications... guidance in the designing of new products. If it's to do with welded tubing, Stan Steel is ready to serve you.
STANDARD TUBE AND T.I. LIMITED
WOODSTOCK • TORONTO • OTTAWA • MONTREAL
Seamless Tubing • Fabrications • Aluminum

Pillofoam

(Continued from page 54)

As each mold approaches the pourer, it is open. Then, as it slowly passes him, he wields a plastic hose, spreading out the foam to a uniform height. Skillfully he levels off overloads and transfers excess material to the following mold. The amount of foam required for each mold is best determined by time filling. Success of this operation, however, is governed greatly by the skill of the pourer and the Oakes frother operator. Travel time on the conveyor is provided for the latex foam to gel before the curing chamber.

Vulcanization temperature in the long steam tunnel is held automatically at 210 deg. F. Steam within the tunnel is trapped effectively by having the major portion well above the entrance and exit openings. Any minor steam spillage out the ends is exhausted by suction ducts.

Between the time cured products are removed from the molds and the molds are refilled, the molds are carried through four conditioning chambers. This procedure is entirely automatic, and on it depends quality and easy stripping.

Cooling is the first step. It is accomplished through the use of drenching sprays of temperature controlled water. Next the molds are rendered completely dry by subjecting them to high velocity air jets. Now comes a passage through an automatic DeVilbiss spray booth for spraying with lubricant. Finally the lubricant is dried and the molds brought to proper refilling temerature by running them through a warm air chamber.

Emerging from the curing tunnel, the molds open automatically. The Pillofoam products are hot and wet. In this condition they require careful handling to prevent distortion. Flash is trimmed off, then, the Pillofoam is conveyed to the washer unit. Hot water—tons of it—are used to remove soap, excess curing chemicals and all traces of odor. The operation includes passage through giant wringer rolls that squeeze the material throughout its porous mass.

Next the washer Pillofoam goes on a very special conveyor belt for a trip through the dryer. This belt is a very costly construction, built of woven stainless steel. Again extreme care is observed to see that each item is placed fully flat on the belt. This continuous, hot-air dryer is a new type, designed and patented by Mechanical Handling Systems Inc., Detroit. The dryer is built in 10-ft. sections, each section having a powerful fan to force hot air through the products as they pass through the section on the mesh belt. Fresh air is brought in at each end of the dryer and passed from section to section to the central exhaust duct. The air is heated by steam coils, thermostatically controlled, in each section, and temperatures vary from 250 deg. F. at the wet-product end to below 200 deg. F. at the dry-product end. A short cooling section follows the dryer, so that the products will not be handled when hot.

The finishing section works only two shifts—days and afternoons, so night shift production is stored on an overhead conveyor built especially for this purpose. Inspection is rigid, and the company is proud of a Dunlop-designed compression-deflection tester which indicates visually the firmness of the finished Pillofoam. This check not only provides a quality gauge point, but guards against wasteful practices—too high density, careless handling, and the like.

Automation is the order of the day at the plant. Four principal conveyors completely eliminate hand or mechanical truck handling of products. One takes care of the filling, curing, stripping and mold reconditioning circuit. A second one carries the cured Pillofoam through the finishing, washing and drying operations. A third stores night shift output and a fourth carries products to the sorting, packing and warehousing sections. Crossover conveyors link the main lines.

Automatic production techniques provide many benefits. Dunlop gains directly through increased efficiency, lowered costs and high man-hour output. ★

when advice is needed about colour in design . . .

Canadian Pittsburgh is geared to solve Canada's toughest finishing problems! Today modern organic coatings are engineering materials which must be specified rigidly in terms of properties. Technicians in Canadian Pittsburgh's Central Development Laboratory can develop the right coating, no matter what the product might be! Using a punch card system, several thousand formulae are classified by twenty-five important physical properties and can be screened in a matter of minutes. With this background information, Pittsburgh technicians can quickly produce exactly the right finish for your specific requirement!

PITTSBURGH EXPERIENCE COUNTS

Why not let us help you solve your product finishing problem? Write Canadian Pittsburgh Industries Limited, 10 Price St., Toronto, Ontario.

CANADIAN PITTSBURGH *Industrial Finishes*

MADE IN CANADA BY

CANADIAN PITTSBURGH INDUSTRIES LIMITED

Bristol Through-Broached Screws Cut Assembly Time, Reduce Waste

Bristol Through-Broached Socket Screws halve the time required to insert set screws in critical parts. In addition, they cut loss of screws due to dropping and cross threading. These patented Bristol screws have all the holding power of a standard socket set screw but, to facilitate machine assembly, the sockets are broached all the way through, so they can be inserted from either end. Write our Socket Screw Division for information.

Precision Socket Screw Manufacturers Since 1913 5B-

THE BRISTOL COMPANY OF CANADA LIMITED

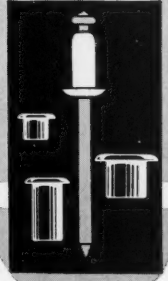
TORONTO HAMILTON MONTREAL VANCOUVER

EYELETS AND "POP" RIVETS

USMC Standardized Eyelets reinforce as well as fasten—they're easy, fast and economical to apply.

"POP" Rivets handle blind spots and open sections—can be driven at rate of 1200 per hour.

Write for catalogues.



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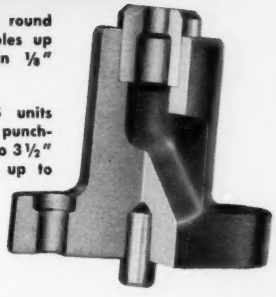
UNITED SHOE MACHINERY COMPANY
OF CANADA LIMITED
MONTREAL • TORONTO • GALT • QUEBEC

WALES CD UNITS increased our hole punching profits!

For punching round or shaped holes up to 2" dia. in ⅛" mild steel.

Other WALES units available for punching holes up to 3½" dia. in stock up to ¾" thick.



● You can always *save* TIME and MONEY with WALES CD Units. ELIMINATE stripper plates, custom punches and dies.
CD Units are mounted in sets — outside the press. Change set-ups in 'jig time'. All parts are interchangeable. Maintenance costs are pared to the bone. Alignment is automatic and accurate. Press down-time is practically non-existent. For multiple hole punching, nothing equals the speed and simplicity of WALES CD punch and die assemblies.

Showing WALES CD Units in same set-up with WALES BL Hole Punching Units and WALES Type N Notching Units in punch press.

Send for BULLETIN No. 8K
The CD story is factual and sure to suggest many ways to enable your hole punching shop to make more money. Sent free.

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"...the Wales-WAY is the PLUS-PROFIT way"
1105 MAIN STREET EAST — Hamilton, Ont.
WALES-STRIPPIT COMPANY, N. TONAWANDA, N. Y.

DEXION

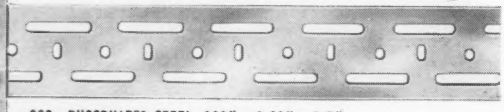
SLOTTED ANGLE

225—PHOSPHATED STEEL .080" x 2.25" x 1.5"
ALUMINUM ALLOY .092" x 2.25" x 1.5"

The first complete

SLOTTED ANGLE SYSTEM

for Canadian Industry



300—PHOSPHATED STEEL .100" x 3.00" x 1.5"

The versatility of Dexion 225 slotted angle has been still further enhanced by the introduction of Dexion 300, of thicker gauge and greater width, for your heavy-duty structures. The DEXION system is the quickest, cheapest, simplest way of getting equipment when you want it, as you want it. For literature, free sample and name of your nearest distributor write to

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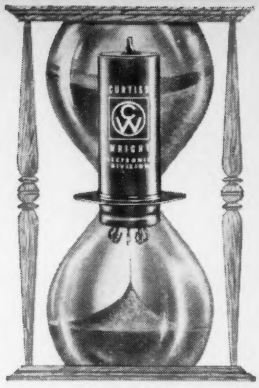
The Curtiss-Wright "SNAPPER"



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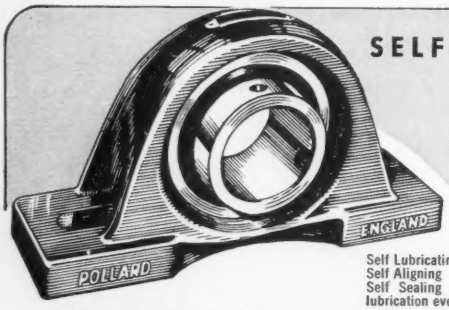

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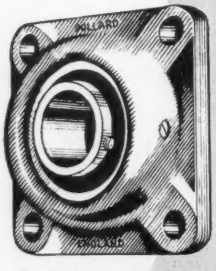

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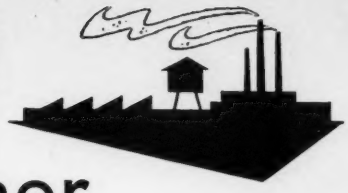

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Editorial

This is one show that must go on

It is a sure sign of the popularity of an artiste when an audience calls for an encore. And it is a sure sign of the popularity of an exhibition when a date is already set for a repeat performance next year.

We refer, of course, to the Canadian I.R.E. Show; so successful was the first one held last month in Toronto, that the date has already been set for next year's Show to be held in Toronto on October 16, 17 and 18.

A most interesting comment came from the American exhibitors. They were unanimous in their opinion that the services afforded them at the exhibition were far and away above anything they get at similar shows in the States. This is praise indeed, when it is remembered how convention-minded they are south of the border, and how much experience they have had in this line.

Elsewhere in this issue, a DESIGN ENGINEERING observer tells you what he saw there and this will give some idea of the scope of the Show, particularly for those who were unable to attend in person.

As C. D. Howe put it when he heard that the Show was to take place, the Canadian Institute of Radio Engineers is to be complimented for its initiative and enterprise in presenting this scientific assembly.

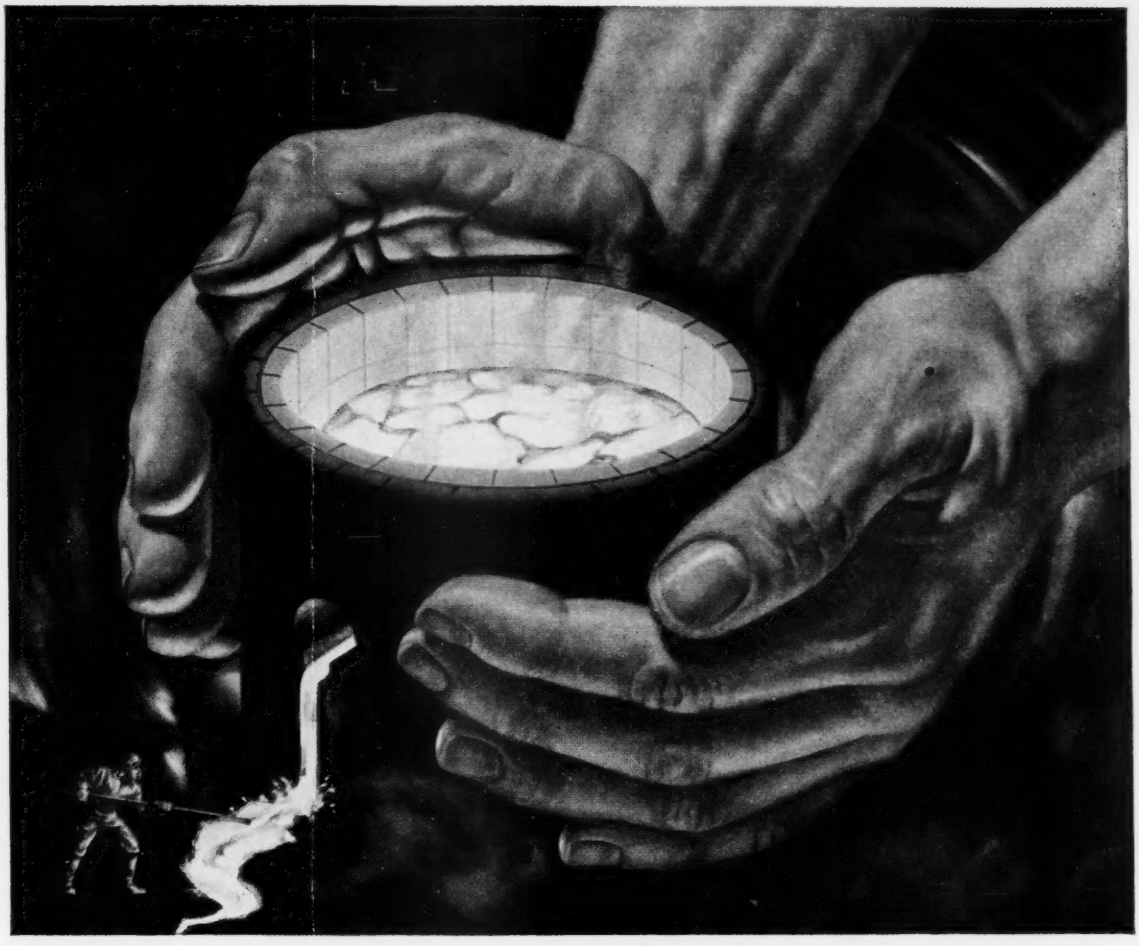
The convention will undoubtedly make a major contribution to the development of electronics as applied to the many and varied needs of industry, science and defense in Canada.

With these statements, we are in complete agreement.

President Hackbusch of the Canadian Radio Technical Planning Board put the matter in a nutshell when he stated that the Show offers the electronics industry an unprecedented opportunity to demonstrate its phenomenal progress.

In our opinion it is imperative that it should go on every year and we hope that you will make a point of being there yourself next October.

William Morse.



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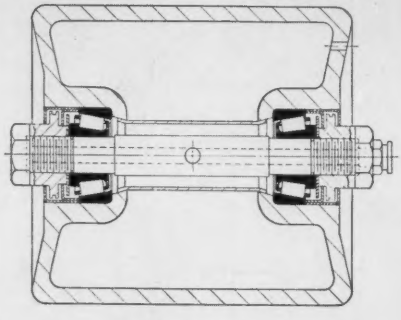

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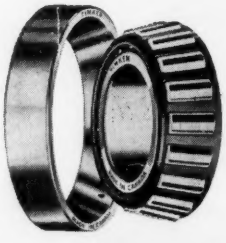

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